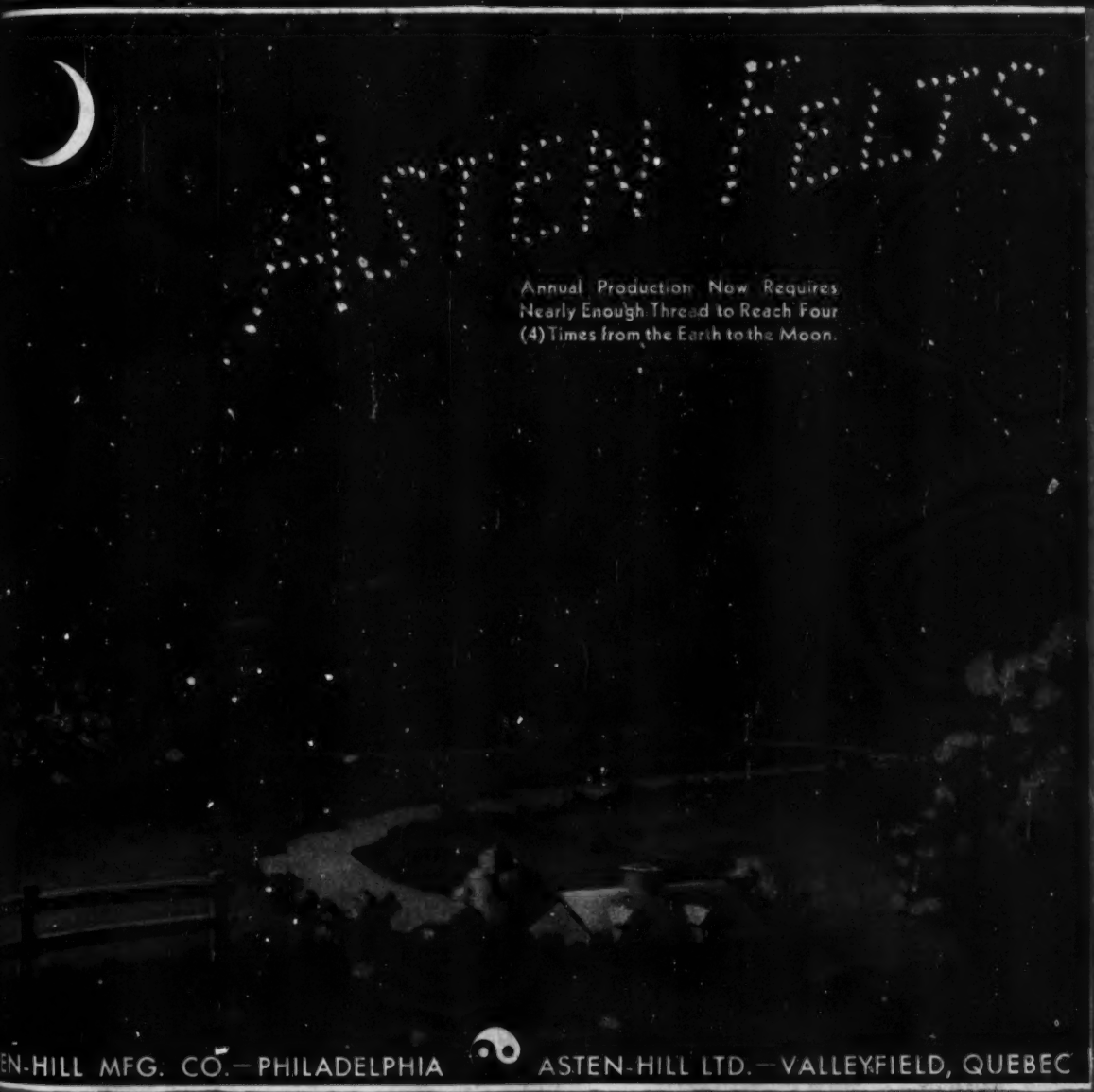
PAPER TRADE JOURNAL

THE INTERNATIONAL WEEKLY OF THE PAPER AND PULP INDUSTRY AND THE PIONEER PUBLICATION IN ITS FIELD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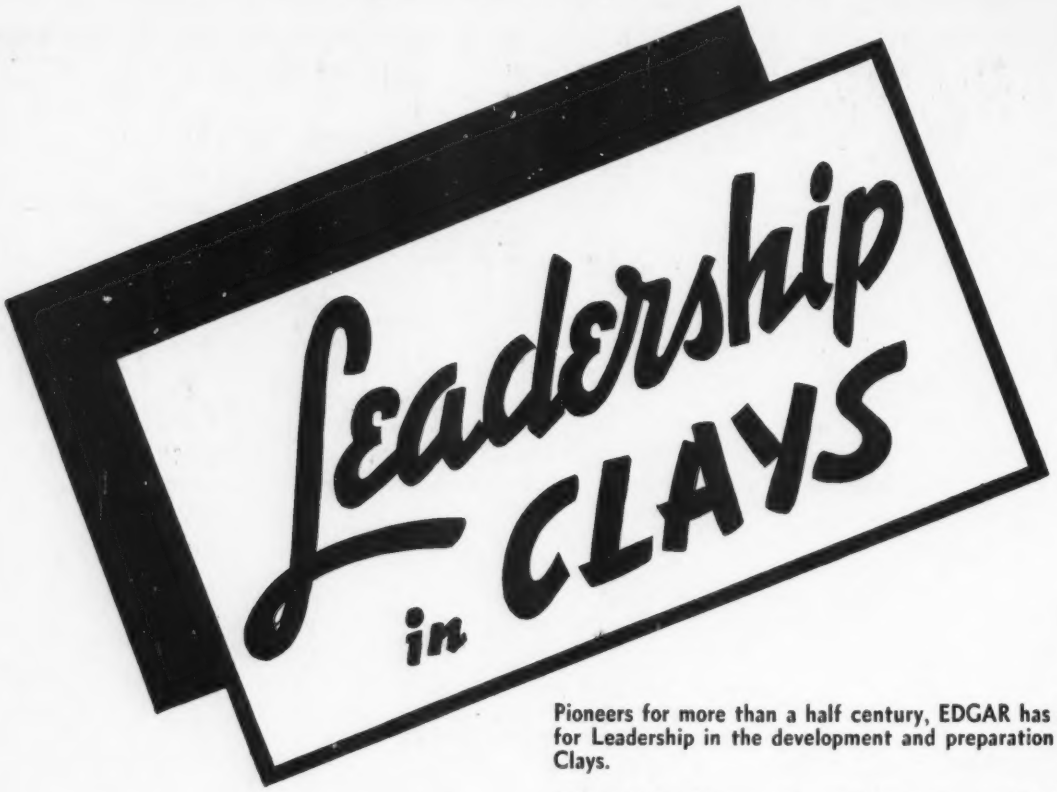

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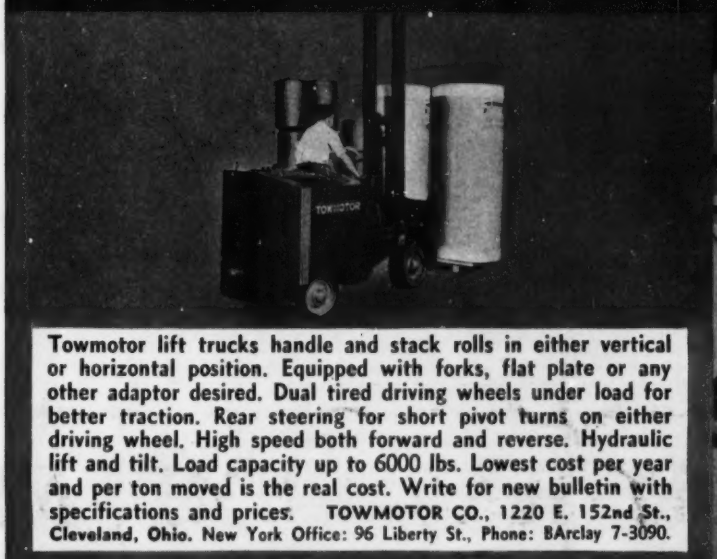

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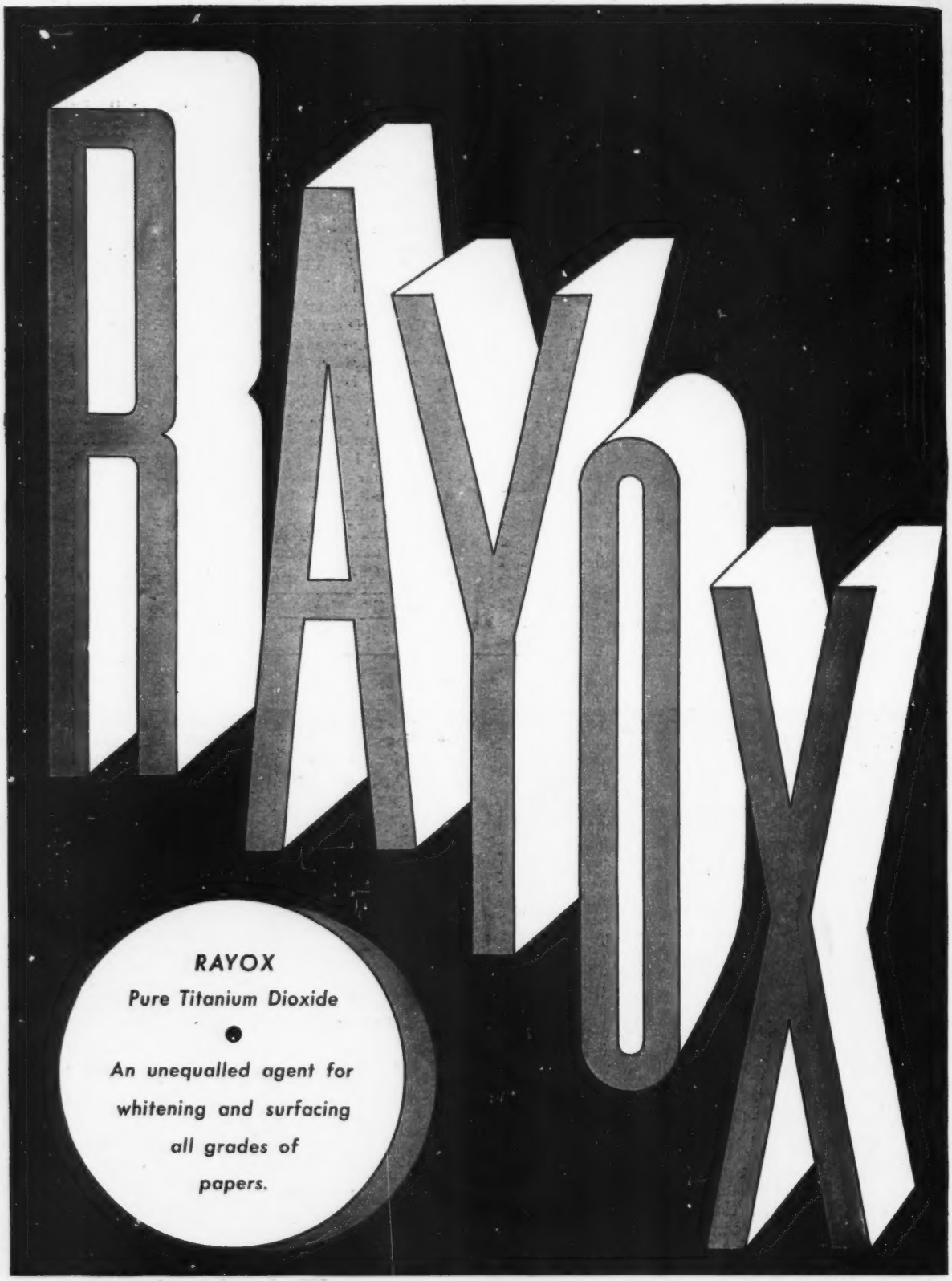

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PAPER TRADE JOURNAL

Reg. U. S. Pat. Off.

SIXTY-SIXTH YEAR

PAPER — PRINTER

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Vol. CV, No. 18 Thursday, November 4, 1937

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To Open Bids for Government Paper Nov. 29

Joint Congressional Printing Committee Will Receive Bids for 36,915,000 Pounds of Various Kinds of Paper for the Use of the United States Government Printing Office for the Six Months Beginning November 29, 1937.

[FROM OUR REGULAR CORRESPONDENT]

WASHINGTON, D. C., November 3, 1937—The Joint Congressional Committee on Printing has announced that it will receive bids on November 29 for the semi-annual supply of paper for the use of the Government Printing Office beginning January 1, 1938. It is expected that awards will be made one week later.

At the last bid opening bids were asked for 36,915,000 pounds of various kinds of paper. At the coming opening bids will be asked for 37,315,000 pounds.

Comparatively few changes were made in the specifications by the paper specifications committee which made the following report in this connection to the Joint Congressional Committee:

The Committee on Paper Specifications respectfully submits its Thirty-fourth Report and the accompanying recommended schedule for paper for the public printing and binding and blank paper for the use of the Government departments and establishments in the District of Columbia for the term of six months, beginning January 1, 1938.

The maximum limitations for rosin content of 100 per cent rag book and writing papers, and sulphite, 25 per cent rag, 50 per cent rag, and 100 per cent rag bond, ledger, and index papers have been increased in order to improve their writing, ruling, and erasing qualities.

Requirements for 100-pound supercalendered book paper were added to the schedule to meet the demands of the executive departments.

The weight and thickness requirements of Oiled Manila Tympan Paper, lot 262 have been modified to obtain paper of better quality.

The papers described in lots 151 and 152, 154 to 157, and 160 to 165, in addition to those specified in the preceding schedule, are required to be delivered on skids instead of in cases.

Due to occupancy of the new warehouse at an early date the delivery point has been changed from f.o.b. Washington, D. C., to f.o.b. Government Printing Office Warehouse or Warehouse Siding.

This schedule embraces 168 lots, being one less than the number in the preceding schedule. The quantity estimated for the term of 6 months beginning January 1, 1938, is approximately 37,315,500 pounds as compared with 36,915,000 pounds for the previous contract period of 6 months.

Quantities Needed

The Joint Committee has estimated that the following quantities of the various kinds of paper will be needed during the six months period:

1,500,000 pounds newsprint paper.
4,620,000 pounds machine-finish book paper.
300,000 pounds antique book paper.
65,000 pounds lightweight machine-finish book paper.
190,000 pounds 50 per cent rag machine-finish book paper.
15,000 pounds 75 per cent rag laid antique book paper.
25,000 pounds 100 per cent rag antique book paper.
2,100,000 pounds supercalendered book paper.
300,000 pounds halftone book paper.
640,000 pounds coated book paper.
20,000 pounds lithograph paper.
3,040,000 pounds mimeograph paper.
400,000 pounds U S M O safety writing paper.
6,000 pounds U S M O writing paper.
4,000 pounds safety writing paper.
5,737,500 pounds writing paper.
320,000 pounds map paper.

(*Cont. on page 23*)

In the advertisement of
GOTTESMAN & COMPANY
INCORPORATED

on the front cover of the October 28th issue of the Paper Trade Journal the third and fourth lines of text below the quotation by Gibbon were transposed by the printer. This paragraph should have read:—

"More than fifty years of experience has meant development of the ability to navigate the changing currents of business and the building of an organization devoted to the interests of the pulp and paper industry."

Kimberly-Clark Co. Voids Labor Contract

Company Discontinues Agreement With Recently Organized Employees' Union, Citing Violation of Wagner Act—Northern To Stop Sale of Power — Fall Mill Starts Production — Employment In Wisconsin Increases.

[FROM OUR REGULAR CORRESPONDENT]

APPLETON, Wis., November 1, 1937—The Kimberly-Clark Corporation, Neenah, Wis., has declared null and void its labor contract signed September 22, 1937 with the recently organized Employees Independent Union, made up of the majority of workers in its six mills. This action was taken after charges had been filed by the International Brotherhood of Paper Makers and the International Brotherhood of Pulp, Sulphite and Paper Mill Workers to the effect that relations between employer and employees were in violation of the Wagner Labor Act. Two days of conferences here held between company and union officials before the decision was announced.

The one-year contract would have continued the present hourly wage scales and basic 36-hour week. Future moves were left up to the employees. Those at the Kimberly, Wis. mill held a mass meeting last week at which they decided to reorganize their own union. A committee of three, H. J. Kokke, Carl Van Ryzin and W. Kaufman, was appointed to work out a plan and submit it at a later meeting.

In a statement issued last week, S. F. Shattuck, vice-president of Kimberly-Clark said: "During the period in which employees were organizing the independent union, certain technical provisions of the Wagner Act were unintentionally violated. The former council plan, for instance, had not been entirely abandoned during the early stages of organization of the union. Under the council plan the company paid wages to employees while engaged in council business other than joint bargaining meetings with management.

"The company also paid, under the council plan, the travelling expenses and hotel bills of employee representatives. At the request of the employee section of the old council plan, the company also provided salary of the full-time secretary of the employees' section. Such practices are named as unfair under the Wagner Act and, inasmuch as there was an overlapping between the outgoing council plan and the incoming independent union, the management of the corporation is charged with unfair labor practices and the independent union is labelled as 'company dominated.'"

It was also stated by Mr. Shattuck that some of the supervisory employees, contrary to instructions, had expressed opinions on membership in the union. The closed shop stipulation written into the contract also was ruled as illegal by the labor relations board. Although 90 per cent of the employees indicated by their membership in the union their desire to be thus represented in dealings with the management, the company felt it might find itself debarred from further dealings with the independent union, therefore agreed to cancellation of the contract. Arrangements were made by the company to take care of a deficit incurred in organizing the union.

Will Discontinue Sale of Power

The Northern Paper Mills, Green Bay, Wis., is discontinuing its operations in the wholesale commercial power field by disposing of its two hydro-electric plants at Chalk Hills and White Rapids, on the Menominee River near Amberg, Wis. Announcement was made last week that the company had entered into an agreement with the Wisconsin Michigan Power Company, a North American subsidiary, to purchase the plants.

Ralph E. Moody, vice-president of the power company, said the deal involves $2,350,000, and is subject to approval by the public service and utilities commissions of Wisconsin and Michigan.

Future power needs of the Northern mills will be met by the erection of a high-pressure steam generating plant on a site adjoining the mills at Green Bay, at an estimated cost of $750,000. Construction is expected to take about two years during which power will be purchased from the Wisconsin Public Service Corporation, which serves Green Bay. This utility's transmission lines are tied in with those maintained by the Northern from its hydro-electric plants, so the company will be able to purchase power from the Wisconsin Michigan line if it desires.

The two hydro-electric plants were erected by the Northern Paper Mills about ten years ago, each with a capacity of 10,000 horsepower. They were operated by a subsidiary known as the Northern Electric Company, but this corporation recently was merged with the Northern Paper Mills to obviate federal classification as a holding company. The output of one plant was sold under contract to the Wisconsin Michigan Power Company, and most of the current from the other was used by the Northern Mills over an 80-mile transmission line built to Green Bay from Amberg. The 132,000-volt "high line" of the Wisconsin Michigan company from Iron Mountain, Mich. to Appleton, Wis., was carried on the Northern's towers under a rental arrangement. The transmission lines were acquired by the new owners as part of the deal.

Frank J. Schneller Retires

After a career of 35 years in the paper industry, Frank J. Schneller has resigned as vice-president and sales manager of the Gilbert Paper Company, Menasha, Wis., and has retired from active service. He has disposed of his home at Neenah, Wis., and he and Mrs. Schneller have taken up residence at 3270 Lake Shore Drive, Chicago, their former home.

After graduation from Lawrence College, Appleton, Wis., in 1902, Mr. Schneller started working for Kimberly-Clark Corporation at Neenah at wages of twelve dollars per month. In 1906 he was transferred to the company's sales office in Chicago. When Kimberly-Clark took over operation of the Neenah Paper Company in 1909, he was placed in charge of sales and has a record of naming all of its mill brands except three. Within two years, he had accomplished national distribution of Neenah Paper Company products, and was said to be the first western mill to break into the eastern market.

Mr. Schneller gave up this position at the outbreak of the World War. He was an officer of the Wisconsin National Guard for a number of years, and went overseas with his company. He served with the Thirty-second (Red Arrow) Division in major engagements and retired with the rank of colonel. When he returned in 1919 he became sales manager of the Gilbert Paper Company. Later he was elected a director and second vice-president, retaining those capacities until his retirement.

The Gilbert mill, since its founding in 1887, had confined its product largely to manufacture of jobbers' private brands and marks. Mill advertised water-marks had become dominant about the time he became associated with the company. A change to this policy brought the company distribution within two years in every prominent paper market in America. All but three of the Gilbert brands also were named by Mr. Schneller. The mill today manufactures more rag bonds and ledgers than any other American fine paper organization.

Employment in Wisconsin Rises

Employment in the paper and printing industries in Wisconsin showed an increase of .9 per cent in the period from August 15 to September 15, according to compilations of the Wisconsin Industrial Commission. This was in line with the general trend of employment in the state during that period. Wages, however, showed a drop attributed to curtailment of working schedules.

Another report by the commission shows the effects of the safety campaigns in the paper mills. Out of 20,296 claims for workmen's compensation handled during the year 1936, only 883 were settlements to workers in paper and paper products industries, although this is one of the state's major industries. The total was the smallest of any of the larger industry groups in the state. Total compensation awards in all industries for the year were $3,787,081.

European Executives Tour Mills

Forty-five European paper mill executives made a recent inspection tour of paper mills of the Fox River Valley. They arrived at Green Bay, Wis. from New York City and after visiting the Northern Paper Mills there proceeded to Appleton, Neenah and Menasha. They were tendered a luncheon during their stay at the Valley Inn at Neenah. The party went from these cities to Chicago, from where they intended to tour a number of paper manufacturing cities in the east.

The executives were from mills of Germany, Switzerland, Jugo-Slavia, Italy, Austria, Finland, Poland and Holland. The tour was arranged by the German Paper Makers Association, with Dr. Fritz Ruehlemann of Dresden, the president, in charge. Their comment was that although the same processes are used in America as in Europe, they found more specialization in United States mills.

Falls Mill Begins Production

Operations have been started by the newly organized Falls Pulp and Paper Company, which last summer purchased the abandoned Falls Manufacturing Company mill at Oconto Falls, Wis. The buildings and machinery have been reconditioned, and seventy men are employed in the mill to date.

Barking, sawing and chipping operations were started October 11 while other equipment was being placed in shape. A digester is now cooking pulp steadily, and the first carloads of commercial pulp are being shippedd out to customers.

Other departments will be placed in operation as fast as market conditions warrant, and the company hopes to start its own paper machines in the near future. The employment list will be doubled at that time.

Officers of the new company are: Clayton Ewing, president; Marshall Smith, vice-president, and E. W. Forkin, secretary-treasurer.

Employees Form Credit Union

Employees of the Combined Locks Paper Company, Combined Locks, Wis., have organized a credit union, and have filed articles of incorporation. Par value of shares is $5 each, with no limit on capital stock. The purpose is to promote thrift and to loan funds to its members.

Marathon Receives Cargo of Sulphite

Marathon Paper Mills Company has received its last ship cargo of sulphite pulp for the season for its mill at Ashland, Wis. The pulp was shipped from Sweden by steamer via Montreal. This is the fifth to be received this year, making a total of approximately 5,500 tons.

Motor Tender Electrocuted

George Krohn, a motor tender, was killed while making repairs on a stalled power circuit at the Nekoosa-Edwards Paper Company's mill at Port Edwards, Wis. He was electrocuted when he grasped an iron pipe with one hand and came in contact with a circuit relay of 440 volts with the other. This was the first fatality at the mill since 1933.

Conrow Bros. Retire from Business

A statement jointly signed by John F. Sarle Company, Inc., and Conrow Brothers under date of November 1 states that "The firm of Conrow Brothers, founded in 1862, retires from active business operations as of this date.

"We are pleased to announce however, that the cordial relations existing for many years between Conrow Brothers and the firm of John F. Sarle Company, Inc., founded in 1854, have culminated in the association of the present executive management and sales staff of Conrow Brothers with John F. Sarle Company, Inc.

"With H. B. Thurston of Conrow Brothers, as a vice-president, joining with J. W. Sparks in a similar capacity to assist Executive Vice-President and General Manager F. M. Van Horne, and with the addition to the present Sarle sales force of the Conrow staff including C. H. Leissler, F. B. Mott, W. B. McDonald, R. Davison, Jr., and F. A. Miller, the John F. Sarle Company, Inc. will have an organization that can be relied upon to serve the stationery and printing trades in a manner worthy of the fine traditions of both houses.

"John F. Sarle Company, Inc. will be headquarters for the well known watermarks and brands formerly carried by Conrow Brothers and with the present extensive Sarle lines they will be in a position to offer to the trade a most comprehensive list of leading papers."

Canada Will Adhere to $50 Ton Newsprint

Great Northern's Cut of $2 Per Ton May Be Disregarded By Other Mills—Balance Between Production and Consumption Sought—Premier Duplessis Determined to Prevent Cut-Price Errors of Past — Other News.

[FROM OUR REGULAR CORRESPONDENT]

MONTREAL, Que., November 1, 1937.—There has been no sign so far that any of the newsprint producers in Canada who have already announced a $50 per ton price for newsprint for the first half of 1938 will retreat from that position as a result of the lower price announced by the Great Northern Paper Company. On the contrary, they seem to be united in a determination to curtail production and regulate the supply so that the $50 price can be fully justified by a proper inventory and by a proper balance between production and consumption. This is hailed here as one of the most constructive events in the history of the industry, as it indicates, in the words of one authority "proper co-operation and a capacity for self-protection in contrast to the independent action of price cutting in the past, when the industry was confronted by more or less similar conditions." It is now calculated that newsprint in stock comprises about two months extra supply, the normal carryover being one month's extra supply. By running the mills five days a week it is anticipated that this position will be corrected before the end of January.

Government Will Check Overproduction

Premier Duplessis, meanwhile, has given out a statement that under no circumstances will the present Quebec Government permit a repetition of the errors of the former regime in the matter of overproduction of newsprint. He indicated that the Government had been in conference with various newsprint producers, and said that because of the importance of the industry to the Province the Government was determined not to permit overproduction which would ruin the industry itself, the employers and workmen, and, generally, do great harm to the province and country. The Government, went on the Premier, possessed the legitimate means of direct and effective action which it would put into application without fear or hesitation if need be. The industry, a national one, was too important to permit of ruinous policies which would cause widespread harm, and loss of revenue to the Government.

"We are happy to say that up to the present the interested people have shown a spirit of co-operation and collaboration which is much to their advantage, and which is all to their honor," said the Premier. "All interested may be convinced that the Government will co-operate with them to safeguard the best interests of the province and the industry."

Value of September Exports Up

The return by the Dominion Bureau of Statistics shows that in September the newsprint exported amounted to 6,173,095 cwt., valued at $11,303,766, as compared with 5,567,360 cwt. valued at $9,755,549 in September, 1936. Of last September's exports 5,175,246 cwt., valued at $9,464,742 went to the United States. Exports of wood pulp in September amounted to 1,435,322 cwt., valued at $3,744,448, as compared with 1,423,556 cwt., valued at $2,906,804 in September, 1936. The effect of increasing prices for chemical pulp was shown by the fact that whereas the volume of unbleached sulphite pulp exported in September was 284,976 cwt. compared with 207,241 cwt. in September, 1936, the value rose to $701,203 as compared to $330,853 in September, 1936, while bleached sulphite at 676,383 and 654,426 cwts., respectively, was valued at $2,079,291, as compared with $1,705,581.

Shortage of Lumbermen

According to the Hon. J. Bourque, Minister of Public Works for Quebec Province, there is a likelihood that the lumber cut this winter will drop below the estimated figure of 450,000,000 cubic feet, as the result of the shortage of woodsmen. This is confirmed by spokesmen for Price Brothers and Co. and the Anglo-American Paper Company.

The Price Brothers' Company official estimated the present shortage at about 20 per cent "in the majority of Quebec lumber camps."

"The woodsman is not a common laborer but a skilled workman and during the depression, many woodsmen went on relief and are still there," the official said.

The Anglo Canadian Paper Company spokesman mentioned labor shortages in lumber camps on the north shore of the St. Lawrence River.

He placed the shortage in the district of Franquelin and Comeau Bay at about 40 per cent. of labor needed for estimated cuts. The shortages were not so noticeable, higher up the river near Quebec, he said.

At the company's limits in Laval district, cuts had been almost completed and sufficient lumbermen were available, the official added.

He believed the shortage in north shore regions was due to road work projects, in that woodsmen would rather remain in the vicinity of Quebec City instead of entering lumber camps.

John D. Haskell Gets Patent

John D. Haskell of Fulton, N. Y., has been granted U. S. Patent No. 2095361 on a variable flow paper pulp machine using variable pitch impeller blades. Mr. Haskell's invention provides for varying the amount and velocity of flow and deposit on the screen of the machine due to the impeller wheel located in the conduit termination.

The pitch of the impeller blades is variable, so that the angle of attack between the impeller blade and the liquid can be instantly changed, and thereby the amount of liquid displaced can be altered while the machine is in operation. The pitch is adjusted manually from outside the machine by means of bevel gears operating through a master bevel pinion operable from the external end of the shaft carrying the impeller.

What Boston Paper Men And Firms Are Doing

Harry J. Dowd Resigns As Chairman of Paper Distributors Cost Finding Committee — Corroflex Div. Gives Sales Demonstration — Carter, Rice & Co. Corp. Complete New Price List — To Give Complimentary Dinner.

[FROM OUR REGULAR CORRESPONDENT]

BOSTON, Mass., November 1, 1937—A very instructive discussion of current market conditions took place at the luncheon meeting of the Paper Distributors Cost Finding Committee, held Friday at the Boston Chamber of Commerce. The group as a whole is feeling reasonably optimistic. Chairman Harry J. Dowd tendered his resignation after a year and a half of service. Mr. Dowd's successor has not been chosen.

Give Sales Demonstration

Sears L. Hallett, sales manager of the Corroflex Division of the Sherman Paper Products Corporation, Newton, Mass., and his assistant, Irving Stoller, gave a highly interesting sales demonstration covering new markets, new uses and general sales data on Corroflex at a sales meeting held Saturday morning at eight o'clock at the office of Carter, Rice & Co., Corp. Streeter Bush presided.

Complete Entire New Price List

Carter, Rice & Co., Corp., have just completed the preparation of an entirely new price list, showing all of their warehouse and mill lines for distribution to the general printing trade. "In view of the extremely unsettled condition of paper prices which has existed during the last twelve-month period, this new book should be a decided boon to the New England printer."

Arnold-Roberts Makes Window Display

In line with their custom of making window displays appropriate to the season, Arnold-Roberts Company, 58 High street, is showing in the window at the right of the office entrance pictures of actual football players, and one in colors of a player kicking a goal, with the words, "Put it Over With D. of C. Papers" as a title. Pennants of various colleges, made of Potomac Velours, in their respective colors, are a part of the display. There is also a poster containing the words, "More Selling Suggestions for Palm Beach Time." All papers displayed in this window are products of the District of Columbia Paper Company.

In the window on the left of the entrance are reminders of the autumn season, including cornstalks, pumpkins and gourds. Here are featured Westvaco papers, printed and illustrated, made by the West Virginia Pulp & Paper Company.

Many passersby stop to see these attractive displays.

To Give Complimentary Dinner

A complimentary dinner will be given by Carter, Rice & Co., Corp., 250 Devonshire street, leading Boston paper merchants, to five of its organization who have been actively and continuously associated with it for the last half-century.

Those to be honored are J. Harry Ellis, merchandising manager of the Wrapping Paper Department, who joined the company in 1884, and the following, all of whom started in 1887: Timothy T. Maloney, of the Candy Specialty Department; Wilbur L. Woodbury, Essex County salesman, Edward P. Dudley and Jeremiah F. O'Connell, city salesman.

The dinner will be held this evening in one of the private dining rooms of the Boston Chamber of Commerce, when a large group from the company, including officers and directors, will join in paying their respects to these stalwarts whose combined service with Carter, Rice & Company aggregates 253 years. Hubert L. Carter, treasurer of the company, will be the toastmaster.

Move to 140 Federal Street

Ernest S. Reid and Robert S. Reid, mill representatives, have removed from 80 Federal street to 140 Federal street, Room 201, where they will have more space. Their new telephone number is Liberty 9690. The announcement of their removal states: "We are preparing for bigger things in 1938." Included in a few reasons for their optimistic forward look for 1938 are notes about mills they represent. Kleen Products, Inc., have gone through a year of preparation for increased service, with new factories and new products. New helps for the paper merchant will be ready soon. The Orchard Paper Company will have in 1938—now ready—the New Fashunmark catalog, a real selling manual of special designed and special imprinted wrapping papers with bags and boxes to match. The Crystal Tissue Company and Hammersley Mfg. Co. continue to furnish high quality tissues, waxed papers, and greaseproof papers, with more than usual prompt service. Wortendyke Manufacturing Company supplies gummed tape and bags that mean satisfied customers.

Wedgwood Coated Offset

The Champion Coated and Fibre Company, Hamilton, Ohio, has placed on the market a new development known as Wedgwood Coated Offset, a coated paper, specially designed for offset lithography. Several of the subjects in their introductory printed piece are done on four colors, 150-line screen. It is understood that this paper will be carried in stock in a number of the standard sizes and weights. George T. Standbridge, Jr., is the Boston representative of the company.

Mutual Paper Co. In Larger Quarters

The Mutual Paper Company, 130 Eastern avenue, Lynn, Mass., is to be located in new and larger quarters at 1715 Hyde Park avenue, Boston (Hyde Park). The telephone number is Hyde Park 2310.

Variable Speed Transmission

A unit of accessory equipment has been announced by the Reeves Pulley Company, of Columbus, Ind. This is the new Reeves differential control, designed to obtain synchronization of machine speeds.

Chicago Awaits Broader Paper Demand

Trade Now Confined to Narrow Limits, With Many Grades of Paper Moving In Restricted Volume — Advance List of Exhibitors At Detroit Mail Meeting — Use of Beidellite For Deinking Paper — Other News.

[FROM OUR REGULAR CORRESPONDENT]

CHICAGO, Ill., November 1, 1937—The Chicago paper market was dull and featureless during the week. Sales representatives whose travels take them beyond the immediate confines of the city indicate that the local market is perhaps more slow than the surrounding territory. Demand is moving in very narrow channels and the actual economic situation, plus the artificial factors troubling general business, have local experts moving cautiously. Specifically, the only major item of interest during the week was the report of a slight weakening in number five sulphite bond paper credited as the result of a desire on the part of local jobbers to move present commitments from their shelves.

Kraft papers, say reports, remain the same marketwise but without the specific fundamental strength of a few weeks ago. Production news and a comparative stalemating of business demand, have combined to bring about a less fortunate position. Books and covers were likewise slow. Specialties markets were virtually unchanged. The board market was also only fair. Groundwoods showed little indication to move out of the narrow range of last week. Newsprint representatives here also reported a slackness attributable in part to general business conditions. Waste papers were reported weak with supply said to be materially in excess of demand at the present time.

D.M.A.A. Contributes to Traveling Exhibit

The D. M. A. A. is making extensive preparations for its contributions to the success of the traveling exhibit which reaches the Hotel Sherman, Chicago, on November 9 to 12. The spirit of "ballyhoo" which is to characterize this year's Show has the attention of every one and a record crowd is confidently expected. The paper industry is expected to have a greater representation than ever before and local paper jobbers and sales representatives are all set to give the paper manufacturers the proper local tie-up. While the main event of the exhibits is expected to be the first showing of the Fifty Direct Mail Leaders of 1937, the introduction of a number of new lines of paper and new uses of paper will draw a major amount of attention.

Advance Reports of Exhibits

Advance reports indicate that the Hammermill lines will be couched in a most impressive exhibit while the Albemarle Paper Company will tie its line of blotting papers directly into the circus theme of the Show. Other exhibitors expected to show their wares in Chicago, most of them with local tie-ups, are the Appleton Coated Paper Company; Oxford Paper Company; Dill & Collins; Strathmore Paper Company, with a popular animated display of Strathmore expressive papers; S. D. Warren Company with its series of panels showing results on Warren Papers; the Linweave Association; Alling & Cory: Howard Paper Company, impressive in its size; Gilbert Paper Company with its new Cardinal Bond; Rising Paper Company with an exhibit showing the results of showmanship in selling; International Paper Company's modernistic exhibit; Mead Sales Corporation; Eastern Manufacturing Company with a third dimensional display and many others. The international angle is to be taken care of by a number of concerns including the Japan Paper Company, Linweave, Champion, Weston and others.

Organizes Four Bowling Teams

While the winter bowling leagues are preparing to get under way, the Chicago Paper Company has even gone so far as to organize four teams of bowlers into a firm league, bowling Tuesday evenings at a downtown hotel. The "Drones" from the department executives, the "Peddlers" from the sales staff; the "Stooges" from the office clerks staff and the "Huskies" from the warehouse department make up the four teams.

Association Secretary on European Trip

Earning a real vacation from his executive duties with the Schwarz Paper Company and his long services as secretary of the Chicago Paper Association, James S. Danehy set sail about the middle of October for a trip to the British Isles and France. Mr. and Mrs. Danehy expect to return to Chicago in plenty of time for the Christmas holidays.

N.P.A. to meet in New York

Notice has been sent out from the Chicago headquarters of the National Paperboard Association, 80 East Jackson Boulevard, of the forthcoming annual meeting of members of the Association to be held in the Jansen Suite of the Waldorf-Astoria Hotel, New York City, commencing at ten a. m. Thursday, November 18.

H. S. Adler, secretary of the Association, reports that the meeting is called for election of officers for the ensuing year and for taking such other action as is specified in the by-laws of the Association.

Industry Shows Decline in September

The paper and printing industry in the seventh federal reserve district showed up in a less favorable light for the week of September 15 as compared to August 15. The 696 reporting industries in Wisconsin, Indiana, Illinois, Michigan and Iowa showed 79,793 wage earners with a total of $2,215,000 earnings. The number of wage earners showed a decline of 0.1 per cent and of earnings of 1.7 per cent as compared to the report on August 15. This compared to an 0.5 per cent decline in the number of wage earners and a 3.6 decline in earnings for the entire manufacturing reporting group.

Financial News of Pulp and Paper Industry

H. J. Brown, President of Brown Co., Urges Bondholders To Send In the Assents — U. S. Gypsum Makes Net of $4,857,570 Profit for First Nine Months — Robert Gair Co. Reports Profits of $179,525 for Sept. Quarter.

New York Stock Exchange

High, Low and Last for the Week Ending November 3, 1937

	High	Low	Last
A. P. W.	4⅛	4	4
Armstrong Cork Co.	46¾	40¼	40¾
Celotex Corp.	32	26	26
Celotex Corp., pf.	60	57¼	60
Certain-Teed Products Corp.	8	6⅞	6⅞
Certain-Teed Products Corp., pf.	31¾	28¾	29
Champion Paper & Fibre Co.	38	30	30
Champion Paper & Fibre Co., pf.	107	105	105
Congoleum-Nairn Co.	26½	24	24¼
Container Corp. of Amer.	18½	16⅝	16⅞
Continental-Diamond Fibre Co.	11½	10⅜	10⅜
Crown-Zellerbach Co.	14¾	12½	12⅝
Crown-Zellerbach Co., pf.	84	76	76
Flintkote Co.	18½	15½	15¾
Robert Gair	7⅛	5⅞	6
Robert Gair, pf.	24⅞	23¼	24
International Paper & Power	14½	10¾	12
International Paper & Power, pf.	54	44½	46½
Johns-Manville Corp.	90	79¼	79¼
Johns-Manville Corp., pf.	123½	123	123
Kimberly-Clark Corp.	27	26	26
MacAndrews & Forbes	30	30	30
MacAndrews & Forbes, pf.	128¼	128¼	128¼
Masonite Corp.	31½	29½	29½
Mead Corp.	16⅞	15⅛	15⅜
Paraffine Companies, Inc.	46	39	39
Paraffine Companies, Inc., pf.	95½	95½	95½
Ruberoid Co.	25	22	22
Scott Paper Co.	37¼	35¾	37
Sutherland Paper Co.	25¼	22½	22½
Union Bag & Paper Corp.	13	11	11¼
United Paperboard Co.	7	5½	6¼
U. S. Gypsum Co.	66½	59	60
U. S. Gypsum Co., pf.	155	155	155

New York Curb Exchange

High, Low and Last for the Week Ending November 3, 1937

	High	Low	Last
American Box Board Co.	13	11½	12
Brown Co., pf.	47	41	41½
St. Regis Paper Co.	4⅞	4¼	4⅜
St. Regis Paper Co., pf.	78¾	76	78
Taggart Corp.	6¼	5½	5½

Asks Assent To Brown Co's Plan

PORTLAND, Me., October 26, 1937 — Herbert J. Brown, president of the Brown Company, largest pulp and paper concern in New England said today that the findings of the Coverdale and Colpitts report substantiates the reorganization plan submitted to the court by the company.

"It should be evident now to all financially interested parties that the reorganization plan was submitted with a full and accurate knowledge of the company's present position and its future earnings prospects," Mr. Brown continued.

"With the report now on file there is no reason for further costly delay in consummating the reorganization. I now urge all remaining bondholders and institutional holders of bonds to send in their assents to the plan so that the company may pay the $145 past due interest on each $1000 bond and re-establish its current bond interest payments."

U. S. Gypsum Shows $4,857,570 Profit

A net profit of $4,857,560 for the first nine months of this year was reported yesterday by the United States Gypsum Company and subsidiaries after deducting depreciation, expenses and taxes, including Federal surtax on undistributed earnings. This is equivalent after dividend requirements on the preferred stock to $3.73 a share on 1,193,156 outstanding common shares. In the corresponding period of 1936 the net profit was $4,189,401, or $3.57 each on 1,192,103 common shares then outstanding.

For the September quarter of this year the company showed a net profit of $1,456,307 after surtax, equal to $1.11 a share, compared to $1,989,631, or $1.55 a share, in the preceding quarter, and $1,947,627, or $1.52 a common share, in the September quarter of last year.

The volume of new residential construction for the first half of the year as indicated by contracts awarded, the company said, was substantially greater than that of the first half of 1936. "Since the middle of the year, however, residential contracts awarded have declined and are currently approximately 25 per cent lower than they were a year ago. Regardless of the current decreased building activity there still exists a shortage in residential space as measured by normal requirements," the company added.

Robert Gair Co. Makes Good Report

Robert Gair Company and subsidiaries for the September quarter report net profit of $179,525 after preferred dividends of subsidiary company. This is equal, after allowing for dividend requirements on the $3 preferred stock, to 7 cents each on 574,613 shares of common stock and compares with $355,789 or 37 cents a common share in preceding quarter. Net profit for the first nine months of 1937 amounted to $851,455 or 75 cents a common share. The statement includes profit of $33,397 on retirement of income notes, and excludes the company's proportionate interest of $14,745 for the third quarter and $85,479 for the nine months period in earnings of companies whose common stock is less than 100 per cent owned.

Marathon Declares Dividend

APPLETON, Wis., November 1, 1937—A dividend of $3 per share on 200,000 shares of $25 par value common stock outstanding has been declared by the board of directors of the Marathon Paper Mills Company, Rothschild, Wis. Payment will be made in shares of 6 per cent preferred stock.

Action of the directors in declaring the dividend followed a meeting of stockholders in which an increase of 6,000 shares in preferred stock was authorized. This issue doubles the number of shares of preferred outstanding. This is the first dividend on common stock since 1930.

Union Bag Declares New Dividend

The Union Bag & Paper Corporation has declared an initial dividend of 12½ cents a share on the new common stock following the recent split-up on a four-for-one basis. This is at the same rate as previously paid on the old stock.

Obituary

E. Kenneth Hunt

[FROM OUR REGULAR CORRESPONDENT]

DAYTON, Ohio, October 30, 1937—E. Kenneth Hunt, aged 45, sales promotion advertising manager of the Champion Paper and Fibre Company, died suddenly Thursday night, Oct. 28, in Hot Springs, Virginia, where he was attending the annual meeting of the Association of National Advertisers.

Mr. Hunt was playing bridge in the Homestead hotel when he suffered a heart attack. He left his home, 57 West Hill Lane, Wyoming, Ohio, for Hot Springs last Saturday. There was no indication that he was ill and associates at the Champion company office today recalled that he said he felt unusually well last Friday.

Recognized as one of the nation's outstanding advertising men, Mr. Hunt frequently addressed advertising, and sales groups. After the Hot Springs convention he planned an extensive trip through the East, and was scheduled to appear before several well known group meetings.

Mr. Hunt was connected with the Champion Paper and Fibre Company for 14 years. During that time he acquired a large circle of friends in Hamilton, Ohio, although he always retained his residence in the Cincinnati area. Before his connection with the Champion company he was with the Proctor and Collier company, Cincinnati, Ohio.

Surviving are the widow, Mrs. Gladys Dixon Hunt, and one son, Dixon Hunt. Funeral arrangements have not been completed.

John Milton Allen

PEWAUKEE, Wis., October 29, 1937—John Milton Allen, whose distinguished service with the Thirty-Second Division in France won him the Croix-de-Guerre, ded in Oak Sanitarium here last night. Mr. Allen was born July 23, 1896, in Grand Rapids. He joined the United States Army in 1916 and later saw two years of active service with the Thirty-Second Division, wnnng the Crox-de-Guerre for bravery in action.

Mr. Allen was graduated from Oberlin College with the class of 1919 and in September, 1921, joined the Sales Department of International Paper Company in Chicago. At the time of his death he was Assistant Sales Manager of the Specialties Division of the Company at headquarters in New York. Mr. Allen was a member of the American Legion.

Cremation service will be held here tomorrow and a Memorial Service at Mr. Allen's home in Quaker Center, Scarsdale, N. Y., Sunday, November 7. Mr. Allen's ashes will be placed in the Arlington National Cemetery.

Surviving are his wife, Mrs. Margaret Belknap Allen, and two children, John Milton Allen, Jr., and Catherine Allen.

Richard A. Campbell

[FROM OUR REGULAR CORRESPONDENT]

KENOSHA, Wis., November 1, 1937—Richard A Campbell, who was associated with several paper mills as superintendent, died at his home here October 26 after a long illness. He was 51 years old.

Mr. Campbell was born at Wrightstown, Wis., and spent his childhood at Appleton, Wis. He worked in paper mills of the Fox River Valley, and in 1912 became superintendent of the Yellow Pine Paper Company, Orange, Texas. Two years later he moved to Shawinegan Falls, Quebec, where he was superintendent of the Belgo Paper Company.

Ill health forced him to give up his mill work, and from 1916 to 1927 he operated a restaurant in Kenosha. He accepted a position with the Itasca Paper Company, Grand Rapids, Minn., and he also worked at Port Huron, Mich. He retired because of his health in 1929 and returned to Kenosha to reside. Burial was made in Calvary cemetery at Racine, Wis.

Fred L. Holt

Fred L. Holt, 73, a founder of the Gummed Products Company, of Troy, N. Y., died recently of uremic poisoning at his home at 14 East Water street, Troy, N. Y. Mr. Holt was treasurer and a director of the company from the time it was founded in April 1914. He retired 10 years ago as general manager.

Mr. Holt was born in Lynn, Mass. and spent many years of his life in Troy. For 15 years he was general superintendent of the Nashua Gummed & Coated Paper Company, of Nashua, N. H.

In addition to his business interests he took an active part in civic and philanthropic affairs. He was a director of the Troy Foundation, a life member of the Troy Rotary Club, a supporter of the Strouder Hospital and other institutions.

Phillipe J. Roy

[FROM OUR REGULAR CORRESPONDENT]

FALL RIVER, Mass., November 1, 1937.—Phillipe J. Roy, 65, founder of the Roy Paper Company, died suddenly at his residence, 350 Eastern avenue, Thursday. Medical Examiner Albert Perron pronounced death due to natural causes.

Mr. Roy was born in St. Octave des Metis, P. Q. He leaves a widow, Mrs. Almanda Morency Roy, and two daughters, Mrs. Lawrence Boudreau and Mrs. Ide Auger of New Bedford. He was a member of Court Notre Dame, Catholic Order of Foresters.

Heller & Merz Open Laboratory

Heller & Merz on November 1 opened a New Paper Application Laboratory at their Chicago Office, located at 146 West Kinzie street. This laboratory will service the Heller & Merz accounts in Minnesota, Wisconsin, Michigan, Indiana, Illinois, Missouri and Kansas. The men who will be in charge of the laboratory have all had years of experience in the company's main laboratories at Bound Brook, N. J.

Bogus Club to Meet December 3

The Bogus Club, composed of salesmen of Charles F. Hubbs & Co., 383 Lafayette street, New York, N. Y., will hold its third annual dinner at 6:30 o'clock Friday, December 3, 1937 at 2 Park avenue, New York, N. Y.

The guest of honor will be Richard C. Kettles, Jr., 1st vice-president of Charles F. Hubbs & Co.

Members of the paper trade can secure tickets from A. J. Jansen, President of the Bogus Club.

GULF DEPENDABILITY PROVED! ON UTAH SALT BEDS

★ ★ ★ ★ ★

87 world and international speed records were smashed by Ab Jenkins in his powerful racing car shown above—raising world's unlimited 24-hour record to average of 157.27 m.p.h. He also broke the 1-hour record at a speed of 177.05 m.p.h.

Car driven by Ab Jenkins photographed while breaking 36 "unlimited" and 36 "Class C" stock closed car records—all well above 100 m.p.h. For 24 hours he averaged 101.72 m.p.h.

Ab Jenkins sets 159 new speed records.... using Gulfpride Oil and No-Nox Ethyl Gasoline

(Supervised and timed by the Contest Board of the American Automobile Association)

NO special lubricants or fuels were used by Ab Jenkins when he recently hung up 159 new speed records with his big racer and his stock car sedan on the Bonneville salt beds in Utah.

He used the same Gulfpride Oil and Gulf No-Nox Ethyl Gasoline that are giving thousands of car owners new motoring economy and satisfaction every day! *The same gas and oil you can buy for your car from any Gulf dealer!*

Gulfpride Oil has unique qualities which make it an ideal lubricant for all operating conditions. It is refined by a special process — Gulf's exclusive and patented Alchlor process — which removes 20% more waste, carbon, gum and sludge-forming elements. The result is an oil of greater stability, greater resistance to oxidation, better lubricating qualities and longer life.

This same refining process is used in the preparation of Gulf's finest industrial lubricants. Thus, operators of steam turbines, air compressors, Diesel engines and many other types of industrial equipment can secure for their engines and machines the same protection against friction, wear and repair expense that Ab Jenkins received from Gulfpride Oil when he made 159 new speed records in Utah. GULF OIL CORPORATION · GULF REFINING COMPANY, GENERAL OFFICES, PITTSBURGH, PA.

GULF INDUSTRIAL LUBRICATION

Make Paper Exhibits at Philadelphia

[FROM OUR REGULAR CORRESPONDENT]

PHILADELPHIA, Pa., November 1, 1937 — The paper industry was well represented at the Direct-Mail Advertising exhibit which opened in the South Garden and Rose Room of the Bellevue-Stratford Hotel in Philadelphia today.

"The Showmanship of Direct-Mail" is aptly portrayed in the very appropriate slogans adopted by the D.MA.A., such as "49 Ways to Use Direct-Mail," "How 27 Industries Use Direct-Mail," "Coordination of Direct-Mail With All Medium" and "The Nine Trails to Sales." The Side-show Midway seemed to be very well patronized, and on all sides could be heard chuckles from those surveying the canvases depicting burlesque caricatures. Among the outstanding displays are The Paper Merchants, Inc., with an attractive showing of Old Deerfield products, made by Millers Falls Paper Company, Millers Falls, N. Y.; The J. R. Howarth Paper Company, with a complete line of Eagle "A" papers, manufactured by American Writing Paper Company and including Coupon Bond, Persian Bond, Acceptance Bond, Trojan Bond, etc.; The Schuylkill Paper Company's display of Rexcell Enamel, made by Rex Paper Company, Kalamazoo, Mich., was aglow with specimens of variegated flowers in a wide range of colors, together with a complete showing of "Permanized" papers, manufactured by Whiting-Plover Company, Stevens Points, Wis. The Thos. W. Price Company is presenting the "Greatest Stream-lined All Purpose Paper for 1937," including Hammermill, Dill and Collins, American Writing and others; Quaker City Paper Company's display consists of, among others, Ticonderoga, English Finish White, Eggshell White and India as well as Crane's Bond Parchment, All Rag, Byron Weston's Rag Bonds, Index Bristols, and Cantine's Coated Papers in gloss and non-gloss finishes. The Strathmore Paper Company was well represented through its Philadelphia distributors, Charles Beck Company, A. Hartung & Company, The Paper House of Penna., and Raymond & McNutt Company. The Appleton Coated Paper Company, Appleton, Wis., likewise displayed colored coated papers for which the distributors in this area are Raymond & McNutt Company, Garrett-Buchanan, Charles Beck and Whiting-Patterson Company. Distributors for its line of white enamels are Whiting-Patterson, The Schuylkill Paper Company, and coated bonds are distributed by Paper Merchants, Inc. P. H. Gladfelter's display was very unique, all of which papers are distributed by Garret Buchanan Company, D. L. Ward Paper Company and S. D. Warren Company. Others with equally attractive displays were Earl A. Buckley, Geo. H. Buchanan Company, Oxford Paper Company, Strathmore Paper Company, Rising Paper Company and Atlantic Paper Company.

At 12:30 the doors of the main ballroom of the Bellevue were opened where luncheon was served to upwards of five hundred men and women who are attending the D.M.A.A. convention. Wm. A. Hentz, Sales Manager for Thos. W. Price Company, presided.

Big Pulp Shipments Expected at Albany

[FROM OUR REGULAR CORRESPONDENT]

ALBANY, N. Y., October 25, 1937—Among the arrivals at the local port this week was the Steamship Snar carrying a cargo of pulp from Hernosand and other Swedish ports. The vessel is discharging approximately 4,500 tons of cargo. Other foreign consignments scheduled to arrive within the next few weeks include the Mallaren, Swedish freighter, and the Kersten Miles and Kosholm in November. Each will carry several thousand tons of pulp for paper mills in Northern New York.

Another recent arrival at the port was the Scanmail, of the American Scantic Line, carrying 7,500 tons of pulp from Gothenburg, Sweden and Helsingfors, Finland. Port officials greeted its arrival recalling that four years ago the vessel carried a large consignment of Russian pulpwood to the terminal here. The vessel is the largest ocean liner to dock here and may mark the unfolding of a transatlantic trade for both cargo and passengers.

Port facilities have been expanded to care for increasing amount of business being handled and the amount of pulp handled here is expected to exceed any previous year. Warehouses and wharfs have been enlarged and improved and brisk business is the general rule at the local port.

Claims of Northern Ontario

Pressure from Sault Ste. Marie and other communities will be brought to bear on Premier Hepburn to insist on an early settlement of Abitibi Power & Paper Co. affairs "to protect interests of Northern Ontario municipalities where mills of the company are situated." The city council of the Sault is sending a delegation to make representations to interview the premier and Hon. Peter Heenan, Minister of Lands and Forests. Other towns are being asked to send delegations. Representative citizens, members of pulp and paper unions and other industrial unions have stated they will back the delegation.

So far there is no word of the other Canadian mills adopting a similar policy to that of Canadian International which has closed down to a 5-day basis, but it is more than likely that before long the balance of the industry will decide on a 5-day schedule. It will not be possible to say that this policy is a general one till the figures on October production are made available.

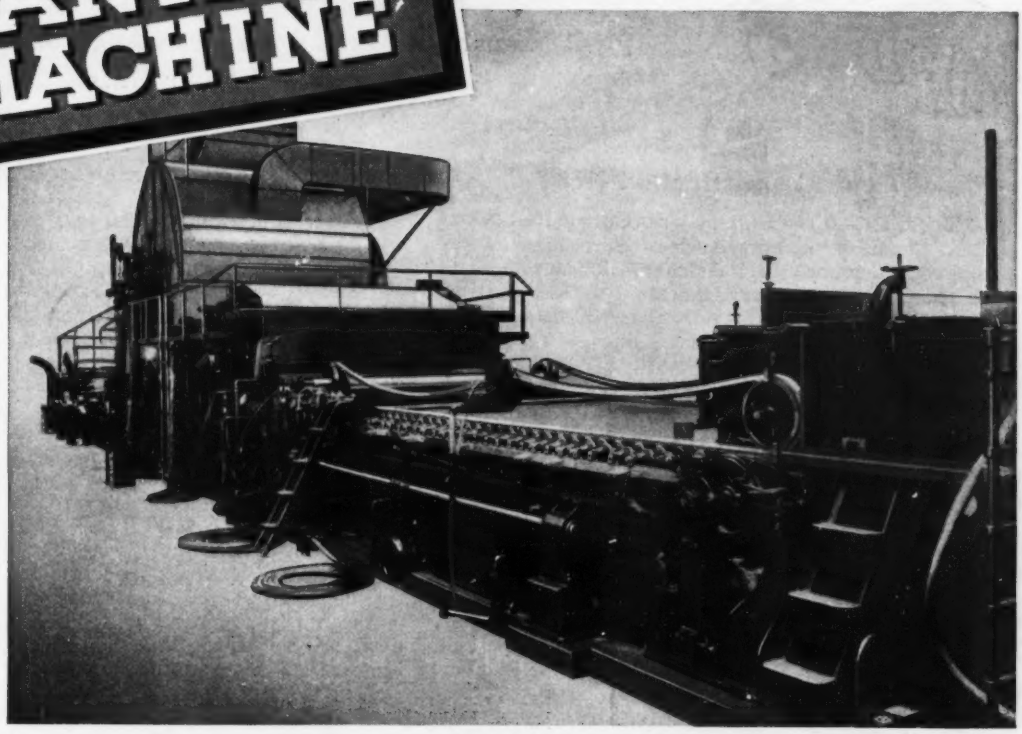
Patten Fine Papers Incorporates

[FROM OUR REGULAR CORRESPONDENT]

APPLETON, Wis., November 1, 1937—Incorporation was announced last week of Patten Fine Papers, Inc., Appleton, Wis. According to articles filed with the secretary of state, the new company is capitalized at 500 shares of stock of no par value. The papers were signed by Judson G. Rosebush, Mrs. Barbara McNaughton Rosebush, and Attorney William L. Crow. Mr. Rosebush is also president of Patten Paper Company, Limited, of Appleton.

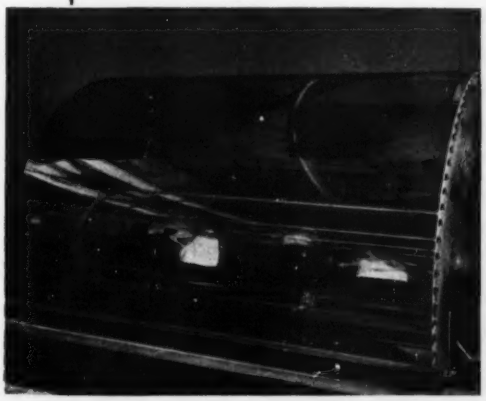
The purpose of the firm is to buy and sell stocks and bonds of corporations engaged in the manufacture of paper and allied products or corporations engaged in any other business, and to manufacture and merchandise paper and allied products.

THE Beloit YANKEE MACHINE



● **The Beloit Yankee Machine furnishes an economical easy means of diversification. No other machine has the all-around adaptability to fit the needs of mills making specialty papers, both light and heavy weights.**

The machine is provided with all the latest features: Removable Fourdrinier ...High Speed Super Shake...Suction Rolls...High Pressure Dryer...Hypoid Drive, etc.

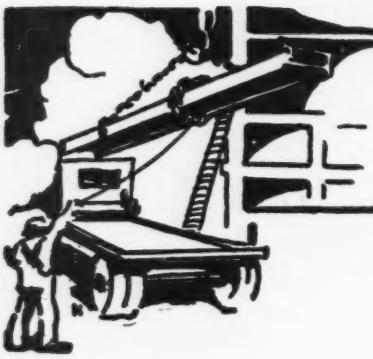


Beloit has developed a special alloy metal and special grinding and polishing process to produce the close grained, hard mirror finish shown in this photograph. This is a result of Beloit's many years of experience in building practically all the Yankee machines in this country.

Beloit has also recently developed a high pressure Yankee dryer to meet the demand for maximum production.

THE BELOIT WAY IS THE MODERN WAY

BELOIT IRON WORKS • BELOIT • WIS.



CONSTRUCTION NEWS

A Summary of Vital Facts Regarding Construction, of Pulp and Paper Mills

General Construction News

Knox, Pa.—The United States Corrugated Fibre Box Company, manufacturer of corrugated boxes and containers, has plans under way for new addition to plant, to be one-story, estimated to cost close to $50,000, including equipment. Bids will be asked on general contract at early date.

Newark, N. J.—The Newark Envelope Company, 71 Clinton street, manufacturer of commercial enevelopes and kindred paper products, has leased space in local industrial building at 58-62 Spring street, totaling about 10,000 square feet, and will remodel and improve for new plant. Present plant will be removed to new location at early date and additional equipment provided for increased capacity.

Berlin, N. H.—The Brown Company, manufacturer of kraft and other paper stocks, rayon pulp, etc., is considering a report of Hardy S. Ferguson & Company, 200 Fifth avenue, New York, N. Y., paper mill engineers, following a survey of mill properties made by that company, recommending expansion in mill at Berlin, including buildings and equipment, for large increase in present capacity, estimated to cost about $3,000,000. The report also recommends similar development of mill of company at La Tuque, Que., operated in name of Brown Corporation, comprising buildings and machinery to double present capacity at estimated cost of $5,000,000.

Chicago, Ill.—The Illinois Shipping Container Company, 1520-30 West Pershing road, manufacturer of folding paper boxes and containers, has begun construction of new two-story addition to plant, 42 x 100 feet, recently noted in these columns, and will push work to completion at earliest date. General erection contract will be carried out by the Anderson & Winblad Company, 6235 South Michigan avenue. New structure is estimated to cost about $50,000, with equipment. A. Epstein, 2001 West Pershing road, Chicago, is architect and engineer.

St. Paul, Minn.—The Globe Paper Box Manufacturing Compay, 1225 University avenue, manufacturer of paper boxes and containers, has asked bids on general contract for remodeling and improving building, consisting for the most part of interior alterations. It is expected to place work under way at early date. Johnson & Johnson, 1507 Randolph street, are architects. J. J. Kaplan is president and treasurer.

Poughkeepsie, N. Y.—The Western Printing and Lithographing Company, 1220 Mound avenue, Racine, Wis., manufacturer of paper specialties, has plans under way for new steam power house at branch plant at Poughkeepsie, with installation of boiler units, pumps, coal and ash conveying apparatus and other equipment; a 150-foot radial brick stack will be built. Structure is estimated to cost close to $50,000, with equipment.

Detroit, Mich.—The National Automotive Fibres, Inc., 19925 Hoover street, is running on a capacity schedule, with full working force in all departments. Company reports orders close to 50 per cent in excess of those on hand at this same time a year ago, and greater than at any other time in the history of the organization. A maximum production basis will be maintained for an indefinite period.

Fernandina, Fla.—Rayonier, Incorporated, recently organized under Delaware laws by officials of the Rainier Pulp and Paper Company, Shelton, Wash., will operate the Fernandina Pulp and Paper Company, Fernandina, as a subsidiary interest. Latter company has work under way on large local mill on the Amelia River in the harbor district of Fernandina, to specialize largely in the production of bleached sulphite pulp for rayon purposes. Several multi-story units are in progress, to be equipped for an initial capacity of about 180 tons of pulp per day. It is understood that mill is expected to be ready for service about the middle of next year. The Rust Engineering Company, Clark Building, Pittsburgh, Pa., has the general erection contract. Cost is estimated close to $6,000,000, with equipment. Rayonier, Incorporated, represents a consolidation of the Rainier Pulp and Paper Company, mentioned, the Grays Harbor Pulp and Paper Company, Hoquiam, Wash., and the Olympic Forest Products Company, Port Angeles, Wash., as recently noted in these columns.

Niagara Falls, N. Y.—The International Paper Company, 220 East 42nd street, New York, N. Y., has awarded contract to the Hagan Corporation, Bowman Building, Pittsburgh, Pa., for automatic control equipment for three boiler units in power house at mill at Niagara Falls.

Menasha, Wis.—The George A. Whiting Paper Company, manufacturer of writing papers and other paper stocks, has awarded final sub-contracts for new boiler plant at mill, now in course of construction, including plumbing installation to A. H. Angermeyer, Neenah, Wis., and will complete work on the structure at early date. It will be 25 x 50 feet, estimated to cost about $45,000, with boiler units and other equipment. General contract is being carried out by the Fluor Brothers Construction Company, 48 Otter street, Oshkosh, Wis., as previously noted in these columns. Orbison & Orbison, 215 East Wash-

ington street, Appleton, Wis., are consulting engineers.

Fort William, Ont.—The Vermilion Lake Pulp Company, Ltd., recently organized, care of A. Dowler, 409 Victoria avenue, Fort William, attorney and representative, has plans under way for new sulphite pulp mill in vicinity of Sioux Lookout, Ont., consisting of several one and multi-story units, with pumping station, power house and other mechanical structures. It will be equipped for a capacity of pulp per day and is estimated to cost over $3,500,000, with equipment. It is said that new mill is scheduled to be ready for operation late in 1938.

Algoma, Ont.—The Huron Forest Products, Ltd., organized several months ago by Canadian and American interests, the latter represented by Walter T. Caten, Room 950, 230 Park avenue, New York, N. Y., is said to have plans maturing for proposed new sulphite pulp mill at Algoma in Algoma-Manitoulin district, near Lake Huron, where site has been selected. It is expected to begin construction early in 1938. Plant will consist of several large one and multi-story units, with power house, pumping station and other auxiliary structures, and is reported to cost close to $3,000,000. George H. Mead, president of the Mead Corporation, Chillicothe, Ohio, and John G. Sutherland are interested in new company.

Morwell, Australia—The Australian Paper Manufacturers, Ltd., Melbourne, Victoria, Australia, has work under way on a new pilot mill at properties at Morwell, Gippsland, Victoria, to be used for experimental operations for the production of paper from eucalyptus pulp wood. Following the completion of this unit near the close of this year, the company will begin construction of a large pulp and paper mill at same location, to occupy a tract of about six acres of land. It will be equipped for large capacity and will require over a year for completion. Entire project is reported to cost over $3,500,000.

Woergl, Austria—Brueder-Mahler, Ltd., Vienna, Austria, manufacturer of paper products, has concluded negotiations for the purchase of a cellulose pulp mill at Woergl, Tyrol, idle for about six years, and will take immediate possession. Structures will be remodeled and improved, with installation of additional equipment and complete modernization of present machinery. It is proposed to have mill ready for service at early date.

Alfred J. Jones Visits America

K. A. Lehto, American manager of Strachan & Henshaw Company, Ltd., states that for the next 8 or 10 weeks, he will be paid a visit by Alfred J. Jones, export sales manager and director of the parent company, Strachan & Henshaw, Ltd., Bristol, England.

During Mr. Jones' visit to this country, both he and Mr. Lehto will visit the plants of American converters and printers, not only with a view of discussing modern converting and printing equipment, but also discussing the general trend of the pulp and paper industry abroad, as compared to that in this country.

Mr. Jones is not only a sales executive, but a practical man, having for some time designed equipment for the E. S. & A. Robinson, Ltd., at Bristol, England, who are the owners of the firm of Strachan & Henshaw, Ltd.

TO OPEN PAPER BIDS NOV. 29

(Continued from page 11)

845,000 pounds manifold paper.
5,366,000 pounds bond paper.
1,026,000 pounds ledger paper.
595,000 pounds index paper.
2,500 pounds tissue paper.
235,000 pounds cover paper.
415,000 pounds manila paper.
536,000 pounds kraft paper.
1,000 pounds paraffin paper.
300,000 sheets gummed paper.
80,000 pounds blotting paper.
2,500 pounds stereotype molding paper.
20,000 pounds oiled manila tympan paper
2,000 pounds plate-wiping paper.
2,000 pounds back-lining paper, for case making.
10,000 pounds high finish red sulphite.
110,000 pounds manila tag board.
1,060,000 pounds calendered tag board.
30,000 pounds manila cardboard.
150,000 sheets railroad board.
480,000 pounds bristol board.
6,000,000 pounds United States postal card bristol board.
19,000 sheets pressboard.
4,000 pounds news board.
810,000 pounds chip and straw board.
15,000 pounds marble grained board.
36,000 pounds box board .
350,000 pounds binder's board.

In cases where more than 1,000 reams are called for, proposals will be received for 1,000 reams or more.

John McEwan Goes With Mohawk Valley

HOLYOKE, Mass., November 2, 1937—John McEwan of College street, South Hadley, for the past 21 years superintendent of the American issue Mills, Inc. of this city has resigned his position effective December 1 to become general manager of the Mohawk Valley Paper Company of Little Falls, N. Y.

Mr. McEwan is a native of Scotland where he learned the trade coming to Holyoke in 1907 and being employed by the American Writing Paper Company for a year after which he became machine tender at the Stony Brook mill of the American Tissue Mills. The following year he was made superintendent of the Pearl City mill of the same company, a position he held until 1916. He was only 23 years old when made superintendent.

Government Paper Bids

WASHINGTON, D. C., November 3, 1937—The Government Printing Office has received the following bids for 300,000 pounds of newsprint paper: Paper Corporation of U. S., 3.375 cents per pound; National Pulp and Paper Company, 2.5 cents; and Old Dominion Paper Company, 2.15 cents.

For 36,000 pounds (86,000 sheets) of manila cardboard: Cauthorne Paper Company, 4.6 cents per pound; R. P. Andrews Paper Company, 4.25 cents; Whitaker Paper Company, 4.4 cents; and Reese & Reese, Inc., 4.57 cents.

For 296 pounds (2,000 sheets) of golden rod book paper: R. P. Andrews Paper Company, 14.6 cents; and John F. Post, Inc., 17 cents.

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COMING EVENTS IN THE PAPER INDUSTRY

NEW ENGLAND SECTION, Technical Association of the Pulp and Paper Industry—Third Friday of each month at the Nonotuck Hotel, Holyoke, Mass.

DELAWARE VALLEY SECTION, Technical Association of the Pulp and Paper Industry—Second Friday of each month at the Engineers Club, Philadelphia, Pa.

LAKE STATES SECTION, Technical Association of the Pulp and Paper Industry—Second Tuesday of each month at the Conway Hotel, Appleton, Wis

KALAMAZOO VALLEY SECTION, Technical Association of the Pulp and Paper Industry—First Thursday of each month at the Park-American Hotel, Kalamazoo, Mich.

FOREIGN PAPER TRADE 50 PER CENT HIGHER THAN YEAR AGO

Exports of paper and paper products from the United States during August 1937 reached an aggregate value of $2,807,426, according to the Pulp and Paper Section of the Forest Products Division of the Bureau of Foreign and Domestic Commerce. This amount does not mark any great change over the values recorded for the two preceding months but is nearly 50 per cent higher than the value recorded for August 1936.

Exports of newsprint, book, and writing papers, sheathing papers and paper boards continue high, although the first two items mentioned failed to reach the level of the previous month. Shipments of paper boards, including box boards, were far ahead of those recorded for the preceding month or the corresponding month last year. Exports of building boards, however, are showing a tendency to slacken. August shipments of both insulating and wall boards were not only considerably lower than the preceding month, but were approximately 10 per cent lower than a year ago. Exports of sheathing papers dropped off about 15 per cent compared with July but more than trebled the August 1936 shipments. While the increase in value as compared with August 1936 is due to some extent to a higher level of prices now in effect, there is no doubt but the volume of shipments this year was substantially higher.

Exports of wood pulp dropped off to some extent during August as compared with July, but at the same time were 67 per cent higher than for the corresponding month last year. Bleached sulphite continues to be an important item, representing about three-fourths of our wood pulp exports. The August shipments of this particular grade were 10 per cent under those recorded for the previous month, but were 75 per cent above the August 1936 shipments. The decline in exports of unbleached sulphite, which constitutes the greater part of the remaining wood pulp shipments, was relatively larger amounting to over 20 per cent. Exports of other paper stock, mostly rag and waste paper, dropped off considerably during August.

Exports under this group reached an aggregate value of $2,298,959 during August as against $2,831,845 during July, and $1,139,104 during August 1936.

Imports of paper base stocks into the United States during August dropped off slightly compared with the preceding month, although the total value of such receipts amounting to $11,731,403 was nearly 20 per cent higher than for the month of August 1936. This increase was due partly to the heavier volume of imports of pulp wood and waste of various sorts, exclusive of rags, and partly to the higher prices in effect this year. Imports of wood pulp, totaling 216,523 tons, dropped off 5 per cent compared with July but were about on a level with the corresponding month last year. Receipts of sulphite pulp were somewhat higher than in 1936, but increases in this class amounting to 7,904 tons, were more than offset by a decline of 9,467 tons in imports of unbleached sulphate pulp. Imports of bleached sulphate pulp and of soda pulp were higher than last year, but those two items are relatively small compared with other items in this group. Imports of paper-making rags, amounting to 6,336 tons were 50 per cent under consignments recorded for last year. Total importations of waste stock during August were valued at $11,731,403 of which $2,133,521 represented pulpwood, $9,199,403 wood pulp, and $398-602 waste for paper making.

Imports of newsprint paper, which make up about 85 per cent of our total paper importations, dropped off 15 per cent during August as compared with the previous month. The total receipts amounting to $260,158 tons, however, were about 6 per cent higher than recorded for the corresponding month last year.

Of the remaining imports, other printing papers, greaseproof and waterproof papers, surface-coated papers, writing papers, and paper boards of various sorts were substantially higher than during the same month last year. Imports of kraft wrapping paper,

another important item on this schedule, were 33 per cent under the preceding month and 51 per cent under the corresponding month in 1936. Imports of pulp boards in rolls show an improvement of 12 per cent over the preceding month, but a decline of 25 per cent compared with August 1936.

Total imports of paper and paper products during August were valued at $11,033,239 of which $9,675,678 represented newsprint and $1,357,561 all other paper and paper products. These figures represent an increase over August 1936 of 10.7 per cent for total imports, 11.2 per cent for newsprint, and 7 per cent for other papers.

Discusses Pacific States Paper Case

WASHINGTON, D. C., November 3, 1937—In the legal section of the annual report of the Federal Trade Commission there is some discussion about the Commission's case in court against the Pacific States Paper Trade Association and others, on the Pacific Coast. In this connection the report said:

"Fines totaling $10,000 were imposed by the Ninth Circuit (San Francisco), March 17, 1937, upon the Pacific States Paper Trade Association and certain of its member companies, including the Zellerbach Paper Company, Blake, Moffitt & Towne, and others, for violation of a decree of that Court entered upon mandate of the Supreme Court of the United States.

"The case originated upon a complaint of the Federal Trade Commission, terminating in a cease and desist order which ultimately was affirmed by the Supreme Court of the United States.

"Imposition of the fines was the outcome of a petition filed by the Commission, May 21, 1936, for a rule requiring the several respondents to show cause why they should not be adjudged in contempt for disobeying the Court's decree affirming the Commission's cease and desist order against price-fixing agreements in the sale of paper and paper products in interstate commerce. The Court's rule was issued June 8, 1936. The respondents filed with the Court a stipulation in which they admitted violation of the decree, and threw themselves on the mercy of the Court. The respondents include large companies on the Pacific Coast engaged in the manufacture and sale of paper and paper products."

Forms Eastern Container Co.

[FROM OUR REGULAR CORRESPONDENT]

HOLYOKE, Mass., November 1, 1937—Frank A. Gerace is the proprietor of a new concern, the Eastern Container Company, not a corporation, established for the manufacture of all kinds of corrugated paper boxes. Mr. Gerace started in the industry with the Sefton Manufacturing Company in 1928. When the Sefton company merged with the Container Corporation of America, he became associated with the latter, subsequently going with the Gibraltar Corrugated Paper Company, North Bergen, N. J. From this concern, he went to the New England Container Company, Inc., Chicopee, Mass., for which he was general manager until a comparatively short time ago. Mr. Gerace was a student of industrial engineering at the University of Alabama and later at New York University.

Production Ratio Report

These statistics are based upon paper production reports to the American Paper and Pulp Association:

COMPARATIVE MONTHLY SUMMARIES

Months	1937	1936	1935	1934
January	90.3%(c)	76.1%	65.8%	—
February	90.1%(c)	77.9%	70.0%	—
March	90.3%(c)	76.0%	70.5%	—
April	92.1%(c)	82.3%	70.0%	—
May	90.6%(c)	81.6%	69.4%	—
June	87.3%(c)	80.7%	72.3%	—
July	81.8%(c)	77.3%	64.9%	—
August	82.9%(c)	81.5%	70.9%	—
September	78.7%(c)	80.5%	71.9%	58.2%
October	—	87.6%	75.6%	64.7%
November	—	88.0%	75.3%	61.7%
December	—	85.9%	71.2%	59.6%
YEAR AVERAGE	—	81.3%	70.5%	—
YEAR TO DATE				
First 42 weeks	86.1%	79.8%	69.8%	—

COMPARATIVE WEEKLY SUMMARIES

CURRENT WEEKS, 1937		CORRESPONDING WEEKS, 1936	
*September 18	82.7%	September 19	85.7%
*September 25	81.9%	September 26	84.3%
*October 2	79.2%	October 3	85.3%
*October 9	77.4%	October 10	87.1%
*October 16	74.0%	October 17	87.6%
*October 23	71.7%	October 24	88.2%

The following statistics show the number of mills reporting by ratio groups:

NUMBER OF MILLS REPORTING, CURRENT WEEKS

Ratio Limits	Sept. 18 1937	Sept. 25 1937	Oct. 2 1937	Oct. 9 1937	Oct. 16 1937	Oct. 23 1937
0% to 50%	87	82	88	92	111	73
51% to 100%	231	233	227	220	196	150
Total Mills Reporting	318	315	315	312	307	223

* Subject to revision until all reports are received.
(c) Basic capacity data have been adjusted to correspond with ratings reported by individual companies.

PAPERBOARD OPERATING RATIOS

According to reports from the National Paperboard Association, per cents of operation, based on "Inch-Hours," were as follows:

Months	1937 %	1936 %	1935 %	1934 %	Months	1937 %	1936 %	1935 %	1934 %
Jan.	80(e)	61	61	—	July	67(e)	69	59	—
Feb.	86(e)	67	67	—	August	74(e)	75	65	—
March	87(e)	68	67	—	Sept.	—	76	69	62
April	89(e)	70	61	—	Oct.	—	82	76	63
May	86(e)	68	61	—	Nov.	—	79	70	56
June	75(e)	68	65	—	Dec.	—	74	60	52

Week ending Sept. 18, 1937—73% Week ending Oct. 9, 1937—67%
Week ending Sept. 25, 1937—70% Week ending Oct. 16, 1937—68%
Week ending Oct. 2, 1937—71% Week ending Oct. 23, 1937—64%
(e) Basic figures revised to include new members of the National Paperboard Assn.

Pay Tribute To Champion Coated Paper

[FROM OUR REGULAR CORRESPONDENT]

HAMILTON, Ohio, November 1, 1937—Tribute to Hamilton's largest industry and the largest of its kind in the world—the Champion Paper and Fibre Company—was paid by more than 100 persons at the initial Hamilton Merchants Association luncheon meeting of the season, Monday noon, October 25 in the Y. W. C. A. auditorium. Homer Gard was the toastmaster and was introduced by Arnold T. Krebs, president of the association. Judge P. P. Boli, of the Butler county common pleas court, was the principal speaker.

Alexander Thomson, chairman of the board of the Champion Paper and Fibre Company, was the guest of honor. Sharing honors with him were these other officials of the mill:

H. W. Suter, vice-president and general sales manager; Clarke Marion, vice-president and production manager; Scott Zoller, secretary and treasurer; J. L. Henson, comptroller and assistant secretary-treasurer; Al Rolfe, superintendent of the paper mill, and Charles Soule, superintendent of the coating mill.

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Section of the
Technical Association of the Pulp and Paper Industry

Edited by Ronald G. Macdonald, Secretary

Instrumentation Studies. XX

A Study of Photoelectric Instruments for the Measurements of Color: Reflectance and Transmittance

Part I. A General Discussion of Color and Color Measurements

By The Staff of The Institute of Paper Chemistry

(Concluded from issue of Oct. 28, 1937)

SECTION IV

Critical Discussion of Spectral, Geometrical, and Photometrical Features of Methods for the Measurement of Spectral Reflectance

The purpose of this section is to amplify the broad outline of the methods of measurements of reflectance as discussed in Section III. The discussion will proceed from two points of view. First, the features of the given method, which define the measurement of reflectance, will be considered. Second, the problem will be further subdivided so that the importance of the effects of the approximation of the characteristics of the parts of an instrument to the ideal ones will be considered under each method.

Since all of the methods of measurement of reflectance use a photocell for the production of a measurable photoelectric current to record the flux of light reflected from a surface, the factors which determine the photoelectric current produced will be considered. The photoelectric current produced by a photocell depends upon the spectral distribution of energy incident upon its surface, and its spectral response. The response of a photoelectric cell to monochromatic light is the current produced per unit of light flux incident upon its surface. For the case in which the *monochromatic* light illuminating the photocell is reflected from a surface, the photoelectric current is directly proportional to the light flux, E, the reflectance, R, of the sample, and the response, S, of the photocell. The photoelectric current, i, is given by the following equation, $i = cERS$, where c is a constant.

When light of a continuous spectrum illuminates the photocell, the response is expressed in the following way. The wave length range covered by the light of the continuous spectrum is divided into intervals of a given wave length width. The photoelectric current is then given by the sum of the responses for each of the wave length intervals.

The different methods of measuring reflectance as classified by the *spectral characteristics* of the illumination of the sample will now be considered. The reader should refer to the chart of Fig. 5.

S1. Reflected Light Monochromatized

The geometry of illuminating and viewing the sample practically defines the measurement of R. The spectral distribution of the light *incident* on the sample is not of primary importance. The lamp should be chosen so that sufficient energy is available throughout the visible spectrum to permit of accurately measurable photoelectric currents for samples of very low reflectance. A tungsten filament lamp operated at a reasonably high color temperature is ordinarily used.

The reflected light is then monochromatized. This is usually accomplished by a prism monochromator. The reflected light enters the prism by means of a slit. A lens projects a parallel beam onto the prism, usually at the angle of minimum deviation, and a second lens forms a series of monochromatic images of the entrance slit in its focal plane. A slit of variable width is placed in the focal plane of the lens, and thereby controls the width of the wave length band emerging from the monochromator. The light is then directed to the photocell surface. It is assumed that the slit widths are so chosen that a good approximation to a monochromatic beam is obtained.

The light reflected from the sheet may give rise to scattered light within the monochromator. This occurs in two ways. If the lenses and prisms are not optically clean, dust particles will scatter light, and these rays may arrive at the exit slit. Secondly, the light which is reflected from the glass surfaces of the prism and lenses may undergo internal reflections and arrive at the exit slit. Careful cleansing of the optical parts and properly placed shields within the monochromator will reduce the scattered light to a minimum. Errors due to scattered light usually arise when measurements are made in the extreme violet region of the spectrum. This occurs

because the low intensity scattered light becomes an appreciable fraction of the monochromatic violet light. The error will become especially important if the spectral sensitivity varies rapidly and happens to be greater for the major portion of the scattered light than for the monochromatic light.

If scattered light is eliminated by the use of a double monochromator, the spectral reflectance curve determined by this method would permit of a more accurate description of the color of a sheet than would be obtained with method (S2).

S2. Incident Light Monochromatized

As in (S1), the geometry of illumination and viewing defines *R*. The requirement of the source for this case, in addition to those mentioned in (S1), is that the shape of the tungsten filament be chosen so that a maximum amount of radiation will be received by the collimator lens of the monochromator. The error introduced by scattered light may become large if especial precautions in design are not taken. Errors due to scattered light will, in general, be larger for instruments of types (S2) than for those of (S1). It is for the purpose of eliminating the error due to scattered radiation that some instruments use a double monochromator. If it be granted that the error due to scattered light is eliminated, there remains still another source of error. This error is due to the response caused by fluorescent light, whose spectral energy distribution may cover a wide wave length range. The error due to fluorescence is very small, in general, for measurements made by methods (S1) and (S2). This error is mentioned here only for completeness.

For certain samples, fluorescent light is observed. The spectral distribution of the fluorescent light may cover an appreciable portion of the visible and/or infra-red spectrum. The magnitude of the intensity of the fluorescent light is very low, and depends upon the spectral energy distribution of the source of light which illuminates the sample. This fluorescent light will cause a photocurrent depending on the transmittance of the optical system between the sample and photocell, and the spectral response of the photocell. Hence, it can be seen that the error will be practically eliminated in methods (S1) and (S3), because of the small fraction of the fluorescent light within the limits of the monochromatic band which is transmitted by the monochromator. The infra-red fluorescence error would be eliminated by the use of a photocell of zero infra-red response.

S3. Monochromatic Incident and Reflected Light

As in (S1) and (S2), *R* is defined by the geometry. The major consideration is to obtain a high intensity lamp and an efficient optical system. Errors due to scattered light may be eliminated. Fluorescence errors are absent. The determination of *R* in this case approaches the ideal one for which *R* is the ratio of the intensities of the reflected to the incident monochromatic light.

S4. Reflected Light Approximately Monochromatized by Filters

Several filters are used in this method to obtain reflectances for several regions of the visible spectrum. It is possible to assign effective wave lengths to a series of stenochromatic filters and plot the values of the reflectance, as obtained with these filters, at the corresponding effective wave lengths. The effective wave length is the wave length corresponding to the centroid of the area of the curve of the product of the spectral energy distribution of the source, the spectral transmittances of all optical parts and filters, and the spectral response of the photocell. When the spectral reflectance curves are straight lines, the value of the monochromatic reflectance at the effective wave length of the filter will be the value of the reflectance as measured by that filter. For all cases in which the change in slope of the spectral reflectance curve is small for the range of wave lengths transmitted by the filter, curves determined by reflectances plotted at the effective wave lengths agree quite well with the spectral reflectance curves as determined by a monochromatic method of the *same* geometry. In order to draw such curves with reasonable approximation, the reflectances determined by the use of about ten filters are necessary. It is quite definite that no approximate curve can be drawn through the points obtained by measurements for three filters. There are two principal reasons for this: First, large wave length ranges are likely to be covered by the three filters used for a three-filter measurement; and, second, a smooth curve representing the reflectance throughout the visible spectrum may hardly be inferred from three plotted points.

Especial emphasis must be placed on the fact that the reflectance, as measured by the non-monochromatic method, is defined by the instrument which is used for the measurement. The characteristics of the instrument, in addition to its geometry, which define the measured value of the reflectance are as follows: spectral energy distribution of the source of light; spectral transmittance of all filters and optical parts between the source and the photocell; and the spectral response of the photocell. The important additional factor in the definition of the measured reflectance is the spectral reflectance of the sample, as determined by a monochromatic method of the same geometry. Since all of these quantities determine the measured value of reflectance, it is impossible to make a valid comparison of the results of one non-monochromatic instrument with those of another unless all of the above factors are known, as well as the way each of these factors affects the measured value of reflectance.

Let us assume that each of the factors entering the definition of reflectance is known. The contributions of the individual factors to the measured reflectance will now be considered. The measured value of the reflectance is the ratio of the total response of the photocell to the light reflected from the sample to the total due to the light reflected from the standard. If the standard is of constant reflectance throughout the spectrum, the measured value of the reflectance of the sample may be interpreted as the *average value* of the reflectance, as measured by a monochromatic method of similar geometry, for the wave lengths transmitted by the filter. This *average value* is a weighted average. The weights given to the monochromatic reflectances in determining the average are directly proportional to the product of the spectral energy distribution of the source, the spectral transmission of all filters and optical parts, and the spectral response of the photocell. In order to estimate the change in the measured value of the reflectance corresponding to a change in either or all of these defining factors, it is necessary to know how the spectral reflectance varies within the wave length range. Let us assume, as an illustration, that the spectral reflectance of a sample increases continuously from 400 to 700 millimicrons. Let us also assume values for the spectral transmittance of the optical system, the spectral response of the photocell, and the spectral energy dis-

tribution of the source of light. The measured value of the reflectance is found to be 50 per cent. Assume that the spectral energy distribution of the source is changed so that it is higher at the long wave lengths than first assumed. The result will be that the measured value of the reflectance is higher than was first determined. The reason for this change is that, due to the increased energy at longer wave lengths, greater weight has been given to the reflectances at these wave lengths. Since these reflectances are greater than the first average value, the increased weight given to these high values will result in a greater average value, which is the result observed. Correspondingly, if any one of the three factors be changed, while the other two are held constant, similar arguments may be made, and thereby estimates made of changes in actual experimental reflectance to be expected from the known differences in the characteristics of the individual factors. Similar arguments may be made when the effective wave length of a given filter is known, in addition to the spectral reflectance curve of the sample in question. Assume again that the spectral reflectance of the sample continuously increases from shorter to longer wave lengths. Assume that the effective wave length of the filter has been found to be 500 millimicrons. The measured value of the reflectance is found to be 50 per cent. Let us estimate the expected change in the reflectance when the spectral energy distribution of the lamp is increased at longer wave lengths. This change in spectral energy distribution will have the effect of increasing the effective wave length for the filter. The measured reflectance will be the value taken from the spectral reflectance curve which corresponds to the new longer effective wave length. In view of the assumptions made, the new value of the reflectance will be greater than the first value.

It must be emphasized that in order to make a quantitative estimate of differences in reflectance values to be expected from different instruments of the same geometry, the spectral reflectance as measured on a monochromatic instrument and the spectral characteristics listed above must be accurately known.

The tungsten filament lamps which are used in (S4) are usually operated at voltages such that appreciable changes in the spectral energy distribution of the lamps occur during the normal life. These changes are due to loss of material from the filament and the deposition of material on the envelope of the lamp. Moreover, a change in lamp voltage will produce a change in spectral energy distribution. Consequently, the apparent reflection of samples which have spectral reflectance curves of appreciable slope will change with the age of the lamp and the lamp voltage, even when the spectral reflectance curves are straight lines.

The fundamental accuracy of the determination of the reflectance depends upon the response of the photocell being caused only by the radiation within the given visible range transmitted by the filter. The principal source of light of wave length different from this is incompletely filtered infra-red light. In a number of instruments which fall in the present class, it has been assumed that the photocell response to the infra-red light of the source is negligible. This assumption is usually based on the fact that according to the published data, the infra-red response of the photocell is low, and consequently the infra-red response is expected to be small compared to the visible response of the photocell. Unfortunately, in view of the very large infra-red output of tungsten filament lamps, this assumption is not, in general, justified. However, there are a number of instruments in which proper precaution has been taken to eliminate this infra-red light.

The errors due to fluorescence may generally be estimated but not predicted. As mentioned in division (S1), the fluorescent light may be visible or near infra-red, and the magnitude of the fluorescence depends upon the spectral distribution of the source and upon the nature of the sample. The errors due to visible fluorescence are generally small for both stenochromatic and wide band filters. There are filters of both the stenochromatic and wide band types which have high transmittances in the near infra-red. If it happens that a photocell of high infra-red sensitivity is used in conjunction with these filters, appreciable errors due to infra-red fluorescence of the samples may be present.

S5. Incident Light Approximately Monochromatized by Filters

The previous considerations with regard to the spectral distribution of the source of light hold for this case, as well as the points covering the spectral transmittances of the filters and the spectral response of the photocell. The errors due to visible fluorescence will be small. However, it may be said that, for certain filters, the infra-red fluorescence errors may be appreciable.

S6. Three Filters

The three-filter instruments are special cases to which the foregoing discussion applies.

The problem of specifying the color of objects on the I.C.I. system will be treated in Section VI. The necessity of the utmost care in knowing the spectral characteristics of source, object, and receiver will be demonstrated in Section VII. There are a number of three-filter instruments, presumably designed for this type of specification, for which it is claimed that their reflectance measurements may be accurately translated into the accepted I.C.I. system of specification. If it be assumed that the geometric and photometric features of the instrument be definite and accurate enough to permit this, there remains the question of how accurately the spectral characteristics of the essential parts are known, and how long they will remain constant.

GEOMETRY

One of the first observations which is made in visually comparing the color of a sheet with that of a standard is that the color of the sheet relative to that of the standard depends markedly upon the angles at which they are viewed and illuminated. It is also observed that glossy or semi-matte surfaces change their colors more rapidly with change in these angles than do samples having matte surfaces. Before the color comparison is made, the samples are oriented until the angles of illumination and of view are such that nearly all of the light received by the eye is diffusely reflected, and very little regularly reflected. These observations indicate that if the reflectance of the sheet is to be measured, the angles of illuminating and of viewing the sheet must be definitely specified. It is the purpose of this division of

Section IV to consider the generally used methods for illuminating and viewing a sheet for the instrumental determination of reflectance. If the intensity of the light reflected from a freshly smoked layer of magnesium oxide be measured for different angles between the reflected beam and the normal to the surface, when the surface is illuminated at 45 deg., it is found that the intensity is nearly directly proportional to the cosine of the angle of observation. The angular distribution of intensity of the reflected light is then said to obey "Lambert's cosine law." A perfectly diffusing surface is one which reflects light according to the Lambert cosine law for *all* angles of incidence (*see* Fig. 6). If such were the case for most materials, this discussion of the geometry of the measuring system would not be written, because the reflectance, as defined in Section I, would be independent of the angles of illuminating and viewing of the sample. Fig. 6 includes illustrations of the angular distribution of reflected light intensity for a perfect diffuser, a semi-matte surface, and a glossy surface. In the following, reference should also be made to the chart of Fig. 5.

G1. Geometry

The geometry of arrangement (G1) is that preferred in the I.C.I. specifications. An approximately parallel beam illuminates the sample at 45 deg. with its normal. The reflected beam is approximately parallel and is normal to the sample. There are many approximations to this geometry which may be described in terms of the maximum cone angles of the incident and reflected beams. The major limitation on these cone angles is that they be sufficiently small to exclude regularly reflected light. Deviations between results on instruments using geometries approximating the accepted one may usually be explained in terms of the differences in the cone angles of the incident and reflected beams, and the nature of the deviations of the angular distribution of the sample from the Lambert cosine law. Of course, it is assumed that the spectral and photometrical features of these instruments are accounted for.

Since there is no axis of symmetry of the reflected radiation, the apparent reflectances of the samples will, in general, depend on their orientation relative to the plane, including the direction of the incident light and the normal to the surface. For a paper sample, a difference in reflectance will be observed when the machine direction is parallel to the plane of incidence, and perpendicular to it.

G2. Geometry

Practically the same considerations apply to geometry (G2). The only difference is the possibility of obtaining better agreement between instruments of different cone angles of the incident and reflected light from what is to be expected in (G1). The reason for this is that the angular distribution of reflected intensity may be expected to be more symmetrical for this case.

G3. Geometry

Geometry (G3) represents the case of illuminating the sample with an approximately parallel beam normal to the surface and measuring a quantity which is proportional to the integral of the angular distribution of the intensity of the reflected light over all angles excepting those included by the apertures of the sphere. For accurate measurements, it is necessary to arrange for the sample and the standard to be simultaneously present as parts of the sphere wall. First, the standard is illuminated, and the illumination of the sphere wall is measured. Secondly,

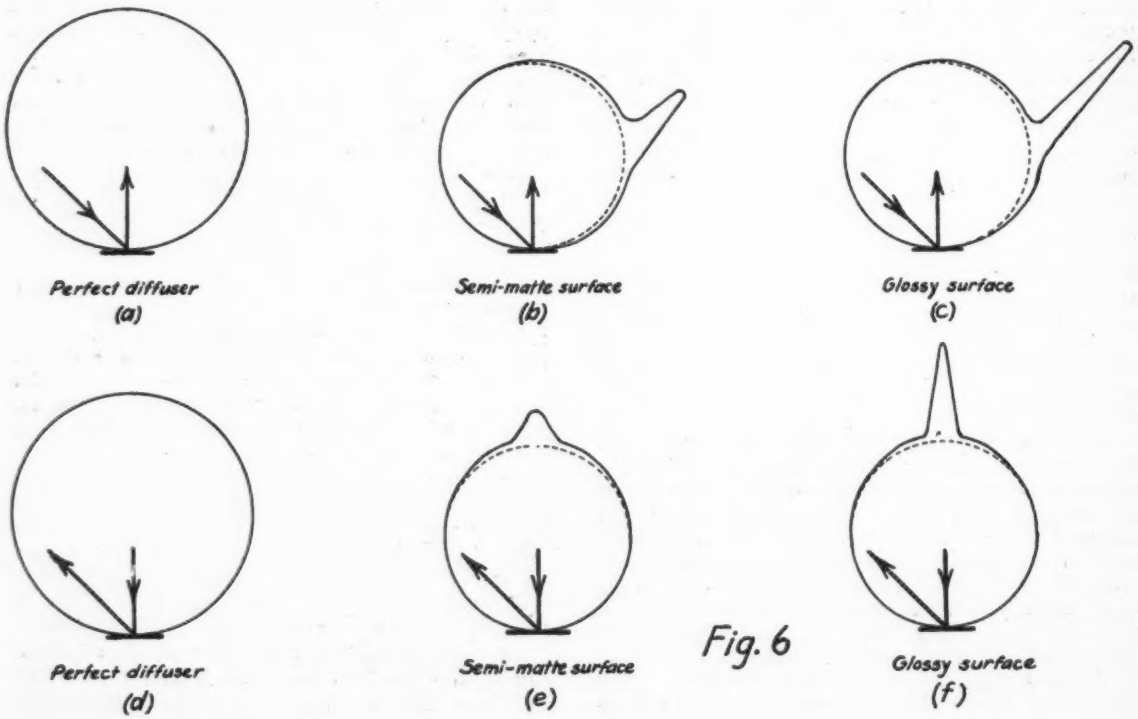

Fig. 6

the sample is illuminated, and the illumination of the sphere wall is measured. The reflectance may then be calculated from these measurements when proper account is taken of the absorption due to the sphere wall, as well as that due to absorption by the areas having absorption coefficients different from that of the sphere wall.

The reflectance for this geometry will be nearly independent of the rotation of the sample relative to the direction of the incident beam, since this direction is an axis of symmetry. It is usually said that surface effects are thus eliminated.

The integrating sphere of this geometry should be used only with the monochromatic methods (S1), (S2), and (S3). If any of the methods (S4), (S5), or (S6) is used, large corrections must be made for the spectral reflectance of the coating of the sphere wall. The correction is especially serious if white paints, rather than magnesium oxide and magnesium carbonate are used to coat the sphere. The reason for the introduction of this correction is the large change in the spectral distribution of the light incident on the photocell which occurs due to the successive reflections within the sphere. Granted that one of the methods (S1), (S2), or (S3) is used with this geometry, there is still another factor which must be considered. If the results obtained with (G1) be compared with those of (G3), an appreciable difference is to be expected for semi-matte and glossy surfaces of low reflectance. This arises due to the deviation of the angular distribution of reflected intensity from the Lambert cosine law. The magnitude of this difference will also depend upon the deviation of the incident beam from an accurately parallel one.

G4. Geometry

The (G4) geometry consists of illuminating the sample with diffuse incident light and viewing it by an approximately parallel beam reflected normally to the surface. The design of the sphere interior will determine the approximation of the angular distribution of the incident light to that of the Lambert cosine law. The principal use of this geometry is in conjunction with spectral type (S1), because of the possibility of providing high intensities of light incident on the sample by placing several lamps within the sphere.

PHOTOMETRY

The methods used for the measurement of the intensities of the light reflected from the sample and from the standard have been left for consideration under the general heading of photometry. It should be the goal of the design of intensity measuring devices to obtain some scale reading which will be directly proportional to the reflected light flux within a given angular range. When this is done, the spatial distribution of intensity of reflected light alone defines the measured monochromatic reflectance. At the present time, there are so many instruments which do not satisfy this goal that it becomes necessary to discuss how even the photometric peculiarities of an instrument enter into the instrumental definition of reflectance.

P6. Direct Reading of Photocurrent

Photometric method (P6) will be considered first. It is here assumed that the measured photoelectric current is directly proportional to the reflected light flux. In actual practice, this linearity rarely obtains. The assumption of linearity is very unsatisfactory in many designs where the blocking-layer type of photocell is employed. Recourse can be had to calibration curves of measured current versus flux which have been obtained by application of the inverse square law of light intensity variation. It is necessary that this calibration be done for the actual instrumental setup, covering the instrumental scale range.

The two variable features of photocells which are common to most photometric arrangements are the variation in the sensitivity over the surface of the photocell, and the variation in the response for a given surface of the photocell depending upon the angle of incidence of the light illuminating it. All three of these factors enter into the instrumental definition of the reflectance, in that they define the photocell response. The last two effects may be minimized by insuring that the same part of the surface of the cell is illuminated at all times and that the angular distribution of the incident light intensity be constant.

Null Methods

All of the methods to be discussed below are null methods, methods which are characterized by the fact that the two photocurrents due to the light from the sample and standard are equal. Null methods are to be distinguished from null balanced methods, the latter providing compensation for any fluctuations of intensity of the light source. The equality of photocurrents is accomplished by varying the incident or the reflected light flux to compensate for the differences in reflectance of sample and standard. The principal assumption as regards the response of the photocell is that equal photo-currents will be produced by equal amounts of light flux of the same spectral energy distribution. In order that this may be generally true, it is necessary that the areal sensitivity be constant, and the angular distribution of incident light intensity, as well as its state of polarization, be the same for the sample and standard. The burden of the responsibility for the accuracy of reflectance measurement then depends on linearity between scale reading and light flux passed by the device which controls the light flux incident upon the photocell.

P3. Iris Diaphragm

Photometric method (P3) will be considered first in this group of null methods. The area of the iris diaphragm is taken proportional to the light flux. The assumptions made are: (1) that parallel light is incident normally on the diaphragm, and (2) that the intensity of the beam incident on the diaphragm is accurately constant over the area of the diaphragm. The accuracy of the reflectance readings is then conditioned by the accuracy with which the areas of the iris diaphragm can be determined. However, it is exceedingly difficult in practice to meet the condition that the intensity of the beam incident on the diaphragm be accurately constant over the diaphragm area.

P2. Sector Diaphragm

For photometric method (P2), that utilizing the sector diaphragm, the assumptions made are (1) that the diaphragm be accurately centered in the beam,

(2) that parallel light be incident normally upon it, and (3) that the light intensity be constant on any circle concentric with the sector diaphragm; a radial variation of intensity is permissible. The burden of responsibility for accuracy is now placed on the measurement of the angles of the open areas of the sector. In this regard, a carefully machined sector diaphragm may be relied upon to within 0.1 per cent. In practice, the theoretical conditions are more nearly satisfied than are those for the iris diaphragm.

P5. Wire Screens

Wire screens [photometric method (P5)] of definite percentage transmission can be used for the variation of the flux incident on the photocell. The main condition to be satisfied here is that parallel light be incident on the screens at an angle equal to that for which the screen was calibrated. The best way to calibrate these screens is to measure their percentage transmission by an accurate photometric method using an optical system equivalent to that in which they are to be used.

P4. Neutral Wedge

The conditions for use of the neutral wedge are (1) the material must be truly achromatic, that is, it must not selectively absorb light of different wave lengths, and (2) for precise control of light flux the light beam must pass through the wedge in the form of a narrow ribbon with the narrow dimension in the direction in which the density of the wedge changes. In actual use the wedge must be calibrated in an optical system identical with that of the instrument.

P1. Polarization

The principles underlying the use of a photometer of the polarizing type, photometric method (P1), are discussed in Section III. In using a photometer it is necessary to provide a means for comparing the photocurrents due to light reflected from the standard and from the sample. The orientation of the Nicol or similar polarizing prism is varied until the reflected light flux transmitted by the Nicol prism for the standard equals that for the sample. The reflectance of the sample is then proportional to the square of the tangent of the angle of orientation relative to one of the axes of the Wollaston prism. In order to accurately record the reflectance to within 0.20 per cent of that of magnesium oxide, it is necessary to have an angular scale which may be read to within 1 minute of arc. Proper correction must be applied to account for the difference in orientation from the 45-degree position which is observed when identical standards are measured against each other. This zero correction depends upon the adjustment of the prisms and the amount of light scattered by the prisms. Care must be taken to have a closely parallel beam incident on the Nicol. If the polarizing system is in the viewing system, and if either beam is partially polarized, it is not possible to read the reflectance directly from a scale calibrated by the tangent square law. It is likely that any error due to partial polarization of the reflected beams will be negligible if geometry (G3) is used.

It is understood that the foregoing discussion holds for the case in which the photometer is placed in the reflected beams. However, appreciable discrepancies may be observed for some materials when the Wollaston and Nicol prisms are placed in the incident beam. The differences are generally small for paper surfaces. They occur when the sample is rotated in a fixed plane. These discrepancies are attributable to the property of the sample of showing different reflectances, depending upon the orientation of the plane of polarization of the incident light relative to some chosen direction in the sample.

There is another possible source of error due to dependence of the photocell response on the direction of the plane of polarization of the light incident on its surface. This error may be eliminated by completely diffusing this incident light.

SECTION V

Critical Discussion of Spectral, Geometrical, and Photometrical Features of Methods for the Measurement of Spectral Transmittance

The characteristic of a transparent or translucent material which is necessary to specify its color when it is illuminated by any given illuminant is the spectral transmittance curve. The monochromatic transmittance of the material is defined as the ratio of the intensity of the transmitted light, within a given angular range, to the intensity of the incident light. When the spectral transmittance of a transparent solution is measured, a correction for the successive reflections between the walls of the container must be made. Usually this correction is made by comparing the spectral transmittance of the solution in the given container with the spectral transmittance of an identical container which contains a solution of constant spectral transmittance and whose index of refraction is the same as that of the solution being measured.

The transmittances of solutions are measured by instruments whose spectral characteristics fall under the same classification as that made in Section IV for the measurement of reflectance. The measurements are made on an instrument designed specifically for the measurement of transmittance, or on an instrument designed for the measurement of reflectance in which provision has been made for the introduction of transparent samples.

The measurement of transmittance as performed by an instrument which falls under the non-monochromatic spectral types is defined by the spectral energy distribution of the source of light, the spectral response of the photocell, the spectral transmittance of all filters and optical parts, and the spectral transmittance of the sample as measured by a monochromatic method of the same geometry. The same arguments made in Section IV [under (S4)] with regard to the expected changes in reflectance which were due to changes in the spectral energy distribution of the light source, the spectral transmittances of all filters and optical parts, and the spectral response of the photocell, hold for the measurement of transmittance, when the term *spectral transmittance* is substituted for the term *spectral reflectance* (of sample), and the term *reflectance* (of sample) is replaced by *transmittance*.

Errors in the measurement of transmittance due to fluorescence are likely to be larger, in the case of solutions, than were expected for the measurement of reflectance of opaque surfaces. This is due principally to the fact that appreciable fluorescence

is observed for solutions more often than is the case with opaque materials.

The photometric features of the instruments for the measurement of reflectance and the discussion of these features hold for the methods used for the measurement of transmittance.

The principal differences between the methods for the measurement of transmittance and those used for the measurement of reflectance are those of geometry; the geometrical differences, are, however, very important.

The transmittance of a transparent or translucent material depends upon the length of path in the material traversed by the light. The simplest arrangement for the measurement of the transmittance of a *transparent* (as contrasted with a translucent) material is that in which a beam of parallel light is used. Provision is made in the optical system for measuring the intensity of the parallel beam after passage through the material. When the sample consists of a clear solution contained in a glass cell, or a solid transparent material with parallel sides, it is necessary that special care be taken in aligning the sample such that its walls are perpendicular to the direction of the incident beam. When this is done, the measured thickness of the solution between the walls of the container, or the thickness of the solid material, is taken as the length of the optical path of the material. A determination of the path length is necessary in order that the transmittance of the material may be calculated for unit thickness. If the value of the transmittance of unit thickness of a transparent material is t, the transmittance of a thickness x, which we will call T, is given by Bouguer's law as t^x. When it is desired to express the transmittance T of a solution in terms of thickness x of the solution, and concentration c of the solute (which is assumed wholly responsible for the absorption of light), the formula $T = e^{\mu x c}$ may be used; e is the base of Naperian logarithms, and μ is the absorption coefficient per unit thickness and per unit concentration. (This equation does not include a factor for loss of light by reflections).

It is seen from the above expression of Bouguer's law that the transmittance of a solution varies exponentially with the thickness. Hence, a small percentage difference in transmittance corresponding to two slightly different optical path lengths is directly proportional to the difference in these path lengths and to the absorption coefficient per unit thickness. Hence, it is seen that if the transmittance of the solution for a given wave length is low, that is, if the absorption coefficient is high, large errors in transmittance may occur if the light traversing the solution is not accurately parallel. It is necessary, therefore, accurately to specify the geometrical conditions actually used in the measurement of transmittances, even for truly transparent substances.

When the substance whose transmittance is being measured is translucent, it is especially important to specify the geometry of the illuminating as well as the geometry of the viewing system. This necessity arises because the angular distribution of the intensity of the transmitted light depends markedly upon the nature of the scattering material in the translucent substance. In addition, the spectral energy distribution depends on the angles made by the transmitted rays with the direction of the incident beam. Since no simple theory exists for these distributions, it is not generally possible to make theoretical corrections for differences in instrumental geometries of illuminating and viewing. It is possible, however, in the case of *slightly* turbid solutions or solids, to arrange the optical system of viewing the transmitted light so that corrections may be made for turbidity. This is done by measuring the transmittance to a parallel beam of light of the solution, in a wave length range for which the true absorption of the solution is negligible. The "parallel transmittance" of the solution, corrected for turbidity, is then given by the ratio of the transmittance at wave lengths for which there is appreciable absorption to the transmittance measured at the wave length for which the absorption is negligible. In order that this correction be strictly valid, it is necessary to establish that the turbidity at the wave lengths corresponding to appreciable absorption is equal to that measured at the wave length for which the absorption was found negligible.

If the standard absorption cell can be furnished with a solution having nearly the same turbidity as that of the "unknown," but nearly zero true absorption (colorless), the above correction for turbidity may be made wave length by wave length. A good example of this is found in the measurement of dye concentration in white waters.

A measurement of the total transmittance, that is, the ratio of the intensity of the light transmitted in the exit hemisphere, summed over all angles, is determined by placing the sample so that the transmitted energy is received by an integrating sphere. This is usually done by placing one surface of the sample in contact with an aperture of the sphere. A *true* measurement of total transmittance of a turbid sample is obtained only when the sample is very thin as compared with the diameter of the aperture. Consequently, special precautions must be taken in the description of the position and thickness of a sample where total transmittance measurements are quoted for turbid samples.

It has been assumed thus far that a parallel beam of light illuminates the material. In the case of solid translucent materials it is often desirable to measure the total transmittance of the sample. The total transmittance greatly depends on the angular distribution of the intensity of the light of the incident beam. In certain calculations of the contrast ratio or printing opacity of a sheet of paper both the total transmittance of the sheet for parallel incident light and the total transmittance for *diffusely* incident light must be known.

SECTION VI

The I.C.I. System of Color Specification[6]

Color and its Psychophysical Interpretation

Color may be considered as the psychological reaction to physical stimulation, and from the psychophysical viewpoint, color may be interpreted through the response of the eye to excitation of its three-color sensations by some physical stimulus. This stimulus is monochromatic or heterochromatic light whose wave lengths range within the bounds of the visible

[6] In connection with this section the following references will be helpful to the reader:
Hardy, A. C. Handbook of colorimetry. Cambridge, The Technology Press, 1936.
Smith, T., and Guild, J. The C.I.E. colorimetric standards and their use. Transactions of the Optical Society 33, no. 3: 73-134 (1931).

spectrum. The problem of matching a color thus becomes one of matching the stimulus exciting that color.

A particular stimulus can be matched by an equivalent stimulus synthesized from three primary stimuli which excite, respectively, the colors red, green, and blue. The specification of the stimulus is effected by determining the various amounts of the three primaries that must be additively combined in the equivalent stimulus. Each of the primaries may be monochromatic or it may be heterochromatic and include bands of wave lengths extending throughout its nominal region of the spectrum and overlapping the adjacent regions. There are but two restrictions on the choice of primaries; (1), some combination of the primaries must match a fourth stimulus called the basic stimulus, which excites the white chosen as standard, and (2), no additive combination of any two of these four stimuli, the cardinal stimuli, may match a third. The amount of each primary put into the equivalent stimulus is measured as a fraction of the amount of that primary used in matching the basic stimulus. The three quantities so determined are known as the tristimulus values of the given stimulus for the particular observer and for the particular choice of cardinal stimuli.

Colorimetry

The function of colorimetry is the determination of the tristimulus values of the stimuli of colors. The application of that function may be illustrated in the following way. A sample of paper is examined under some illuminant and a specification of the color is desired. The sample is placed in a colorimeter and illuminated by the same illuminant. The light reflected by the sample passes to the proper part of a photometric field and constitutes the stimulus for which an equivalent is to be found in terms of the primary stimuli. The geometry of illumination and viewing affects the spectral energy distribution of the reflected light in the manner described in Section IV. The observer looks through the eyepiece of the colorimeter and sees a field sharply divided into two parts. In one part of the field he sees the light reflected from the sample. In the other part of the field he sees the color resulting from the combination of three primaries. The color in this second part of the photometric field may be varied by controlling the relative amounts of the primaries by means of three manual controls. Adjustment of the controls is made by the observer until the colors in the two parts of the field match. The readings of the scales attached to the controls yield the tristimulus values of the particular intensity of light reflected from the sample. These values are reduced to the values for unit intensity of stimulus. These final tristimulus values constitute one specification of the color of the sample as viewed under that illuminant.

It must be emphasized again that the stimulus specified by these tristimulus values is equivalent to the stimulus of the light reflected from the sample to the eye, and hence the color match is valid, only for the particular observer, for the particular cardinal stimuli, and for the particular illuminant. Other observers would obtain specifications differing slightly from this specification, even though they used the same instrument and identical conditions. This unavoidable variation in the characteristics of individual observers demands that, for accurate specification of color by visual colorimetry, the data of a number of selected observers be averaged.

It is found that the specification of many colors, particularly spectrum colors, requires the use of negative tristimulus values. A negative tristimulus value in the specification of a color means that the color cannot be matched by the direct method described, but that it is necessary to throw one primary onto the other part of the photometric field and vary the intensities of all three primaries until equivalence is obtained between the stimulus of the two primaries and that of the given stimulus and the third primary. The tristimulus value of this third primary is recorded as negative.

Colorimetric specifications made on the basis of one choice of cardinal stimuli may be converted to equivalent specifications on the basis of another choice by use of a mathematical transformation.

The I.C.I. Standard Observer

Several unpleasant features of visual colorimetry were eliminated in 1931 when the International Commission on Illumination adopted certain standards and specifications. The benefits consisted not only in the standardization of colorimetric practice but in making possible indirect colorimetry through use of spectrophotometric data, which, as has been shown earlier in this report, is independent of the characteristics of the observer.

The data of Wright and of Guild, obtained with a number of selected normal observers, was used to calculate a set of averaged tristimulus distribution functions. These tristimulus distribution functions give the tristimulus values of unit intensity of the spectrum colors as they would be obtained by an "average" observer using specified cardinal stimuli. For convenience in practice these averaged distribu-

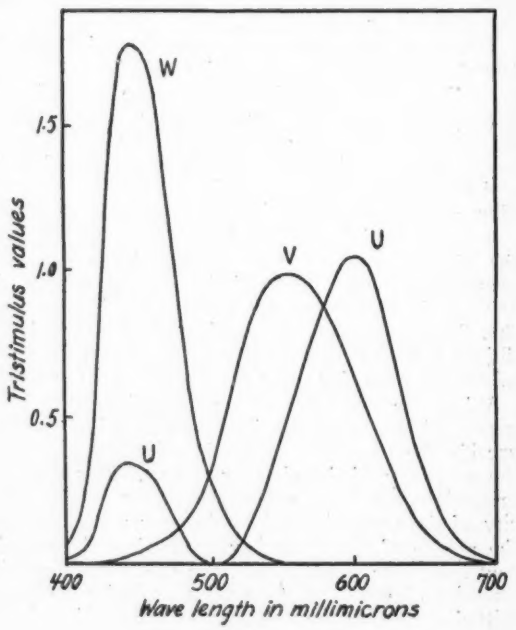

Fig. 7

tion functions were then transformed to the equivalent functions (Fig. 7) based on a new choice of primary and basic stimuli such that only positive tristimulus values were necessary to specify any real color. Such a transformation was made possible by the choice of unreal primary and basic stimuli. (The adjective *cardinal* is reserved for real, i.e., physically realizable stimuli.)

This unreality offers no practical difficulty, however, for the primary and basic stimuli are the means to an end, that end being the specification of a color on a convenient and standard scale. A colorimeter is now calibrated and used with cardinal stimuli whose values are prescribed in the units of the standard scale. The tristimulus values obtained with an instrument so calibrated are transformed to equivalent values on the standard scale defined by the unreal primary and basic stimuli. The values so obtained are the values that would be given by the hypothetical I.C.I. standard observer using the unreal primary and basic stimuli.

The unreality of the standard primary stimuli lies in the fact that they are more saturated than spectrum colors which by definition are the "purest" colors physically available. The standard basic stimulus is an equal-energy illuminant, i.e., an illuminant whose spectral energy distribution is constant across the spectrum.

The primary stimuli recommended for use in practice and whose values are prescribed in terms of the standard stimuli are monochromatic radiations of wave length 700, 546.1 (green line of the mercury arc), and 435.8 millicrons (blue line of the mercury arc.) The basic stimulus is the I.C.I. illuminant *B*, which is an approximation to mean noon sun light.

The specification of the color of a given sample as seen under a certain illuminant now consists in the determination of the tristimulus values of the stimulus as observed by the particular observer on a given colorimeter and in the transformation of those actual tristimulus values, characteristic of the particular observer, to the standard values that would be given by the hypothetical I.C.I. standard observer were he to view the same sample under the same conditions and use a colorimeter employing the unreal standard primaries.

Trichromatic Coefficients and the Chromaticity Diagram

It is now convenient to introduce three new quantities to be used in the specification of a stimulus and its associated color. These quantities are the trichromatic coefficients, x, y, and z, which are defined as follows:

$$x = \frac{X}{X+Y+Z}, \quad y = \frac{Y}{X+Y+Z}, \quad z = \frac{Z}{X+Y+Z}.$$

x, y, and z are the trichromatic coefficients of a color whose tristimulus values are X, Y, and Z (corresponding to tristimulus values U, V, W of spectrum colors). It follows from the above definition that

$$x + y + z = 1,$$

and it is seen that the possible values of x, y, or z fall between 0 and 1.

The specification of any two of the coefficients fixes the value of the third, as may be seen from the equation above. This fact makes possible a convenient and an instructive graphical representation of color. Fig. 8 shows a graph on which are plotted the x and y values of the spectrum colors. Any two of the coefficients might have been chosen but x and y are the conventional choice. This graph is called a chromaticity diagram. The solid curve is called

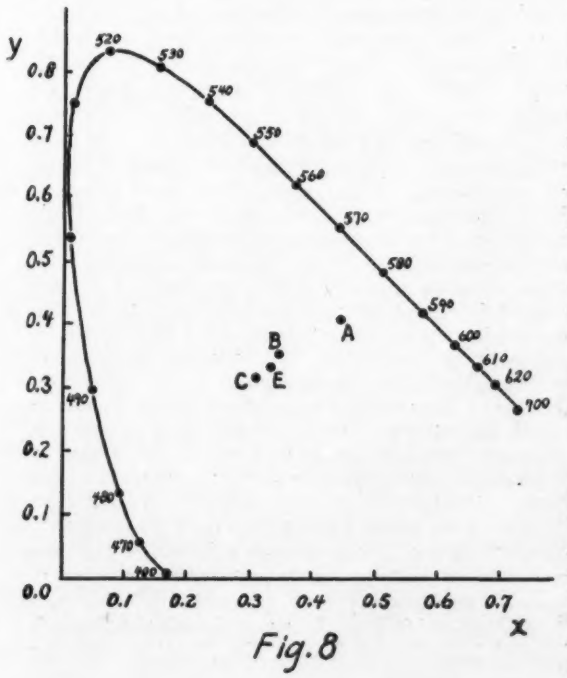

Fig. 8

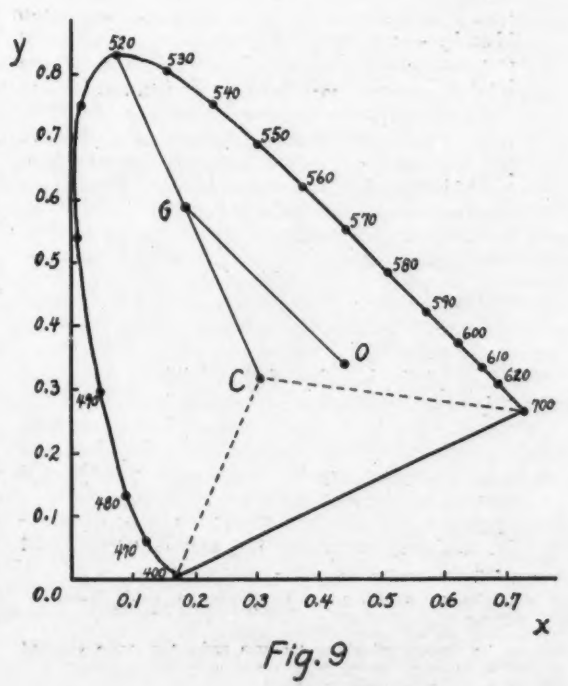

Fig. 9

the spectrum locus and connects the points specifying the spectrum colors. The points *A*, *B*, *C*, and *E* are, respectively, the points specifying I.C.I. illuminants *A*, *B*, and *C* and an equal-energy illuminant.

Points *O* and *G* in Fig. 9 specify an orange and a green color, respectively. Because of the additive property of tristimulus values, and, therefore, of trichromatic coefficients, the line connecting *O* and *G* is the locus of all the points that specify colors obtainable by additively mixing *O* and *G* in any proportions. An extension of this idea leads to the conclusion that the representative points of all real colors must lie within the area bounded by the spectrum locus and the line closing that curve, as each real color may be interpreted as an additive mixture of two spectrum colors. The line closing the spectrum locus may be considered the locus of points representing the saturated purples, mixtures of red and violet in various proportions. Furthermore, it is obvious that any real color represented by a point within the spectrum locus and above the dashed lines through *C*, the illuminant point, may be thought of as a mixture of the illuminant and a spectrum color, e.g., the color represented by *G*, in Fig. 9, may be considered a mixture of illuminant *C* and a spectrum color having a wave length of 520 millimicrons.

Colors represented by points in the area below the dashed lines through *C* are the purples.

Luminosity

In establishing the standard tristimulus distribution functions (Fig. 7) by a mathematical transformation of the averaged results of a number of observers, the I.C.I. chose a transformation that made the *V* function identical with the standard visibility function of the eye.

The visibility curve (*V* curve of Fig. 7) gives the relative luminous efficiencies (luminosities of unit intensity) of light as a function of the wave length. For example, if *E* is the relative spectral energy distribution of the light and *V* is the visibility function, the luminosity of the light of wave length between 499.5 and 500.5 millimicrons is *EV*, when *E* and *V* have their values at 500 millimicrons. If the range of wave lengths in the light is from (500—*a*) to (500+*a*) millimicrons, the luminosity is $2aEV$. When the light includes a significant range of wave lengths, the range is divided into intervals of specified wave length width and the luminosity of each interval calculated,[7] as illustrated above. The luminosity of the entire range of wave lengths is then the sum of the luminosities of the individual intervals.[8] The criterion for width of the intervals is that the total luminosity calculated for the chosen interval width be not significantly different from the total luminosity calculated for a smaller interval width.

Because of the identity of the visibility curve and *V* tristimulus distribution curve, and because of the additive nature of tristimulus values, it follows that, if the luminosity just calculated is reduced to the luminous efficiency, the latter value is also the tristimulus, *Y*, of the light.

In practice, the absolute spectral energy distribution of the light reaching the eye is usually not known, only the relative distribution being known. Hence, either relative luminosities or luminous efficiencies are calculated.

In the particular case of light reflected from a sample, the ratio of the luminosity of the reflected light to the luminosity of the light reflected from a perfect, diffuse reflector[9] is called the visual efficiency of the sample.[10] The intensity of monochromatic (unit wave length interval width) light reaching the eye is *ER*; *E* is the spectral energy distribution of the light falling on the sample and *R* is the spectral reflectance of the sample. The luminosity of this monochromatic light is *ERV*. The wave length range of the light from the illuminant is divided into appropriate wave length intervals, of width *a*, and the products *ERV* and *EV* are calculated for each interval. The sum of the products *ERV* is the relative luminosity of the light reflected to the eye from the sample and the sum of the products *EV* is the relative luminosity of the light reflected from a perfect diffuse reflector put in place of the sample. The ratio of the sum of *ERV* to the sum of *EV* is the visual efficiency of the sample. The visual efficiency of a material is thus seen to be of the nature of a weighted, or effective, reflectance.

Dominant Wave Length

The wave length of the spectrum stimulus that must be added to the light of the illuminant in order to match the stimulus of a given color is called the dominant wave length of that color, e.g., 520 millimicrons is the dominant wave length of the color represented by the point *G* in Fig. 9. Dominant wave length is an objective measure of the subjective quality, hue.

It follows from the definition of dominant wave length that its value depends on the choice of illuminant. In Fig. 10, the point *G* represents another green color, as viewed under illuminant *C* by the standard observer and specified on the I.C.I. system. Its dominant wave length for that illuminant is 520 millimicrons. Its dominant wave length for illuminant *A*, however, is 500 millimicrons. There is a slight difference in the significance of the two values that should be kept in mind. If *G* is considered solely as the representative point of a stimulus, without regard to its origin, the dominant wave length of 520 millimicrons for illuminant *C* and that of 500 millimicrons for illuminant *A* are equally pertinent. If, however, *G* is thought of as representative of the color of a particular sample, the dominant wave length of 520 millimicrons for illuminant *C*, the illuminant for which *G* specifies the color of the sample, measures the hue, while the dominant wave length of 500 millimicrons for illuminant *A* does not specify the hue of the sample when viewed under illuminant *A*. In the latter case the dominant wave length tells what spectrum color must be added to illuminant *A* to produce a color that the standard observer would consider identical to the color of the sample when he viewed it under illuminant *C*. If the standard observer viewed the sample under illuminant *A*, his

[7] Tables of the values of the tristimulus distribution functions and of the relative spectral energy distribution of I.C.I. illuminants A, B, and C are given in the references cited in footnote 5.

[8] Strictly, this sum over a finite number of intervals should be replaced by the integral giving the area under the curves obtained by plotting *EV* as a function of wave length.

[9] In actual practice, a properly surfaced block of magnesium carbonate, or a properly prepared surface of magnesium oxide is taken to be a perfect, diffuse reflector.

[10] In agreement with Hardy, we believe that visual efficiency is a more appropriate term for what has variously been called "brightness", "brightness factor", "visual reflectance", "luminous efficiency", etc.

specification would be given by some point other than *G*.

The extension of the idea of dominant wave length to the purple colors is not direct, for no one spectrum color added to an illuminant yields a purple. In Fig. 10, *P* specifies a stimulus which excites the color of a bluish purple. The point marked 560*c* represents the mixture of blue and red that must be added to illuminant *C* to make up a stimulus equivalent to that of *P*. The complementary of the stimulus specified by *P* is given by *G'*, and it has a dominant wave length of 560 millimicrons. The dominant wave length of *P* is then said to be 560*c*, meaning that a stimulus which is complementary to the spectrum stimulus having a wave length of 560 millimicrons must be added to the stimulus of the illuminant, *C*, to produce the stimulus specified by *P*. An equivalent procedure would be to match the stimulus of illuminant *C* by adding to the stimulus of *P* a spectrum stimulus of wave length 560 millimicrons.

Excitation Purity

An objective specification of purity is obtained from the chromaticity diagram by defining excitation purity as the ratio of the distance between the points specifying the illuminant and the sample color to the distance between the points specifying the illuminant and the dominant wave length of the sample color, e.g., in Fig. 10 the excitation purity of the stimulus specified by *G* is the ratio of *C*—*G* to *C*—520, which is 0.258, or 25.8 per cent. Similarly, the excitation purity of the stimulus specified by *P* is the ratio of *C*—*P* to *C*—560*c*, which is 0.273, or 27.3 per cent. The excitation purity of the spectrum colors is unity, or 100 per cent.

Excitation purity, as thus defined, must be distinguished from colorimetric purity, which is defined as the ratio of the luminosity of the spectrum color which must be added to the illuminant to match a given color, to the luminosity of the mixture of spectrum color and illuminant.

The specification of a color is now complete, and it consists in specifying the trichromatic coefficients, *x* and *y* (or any two of the three coefficients), and the luminous efficiency, *Y*. In addition, objective values may be given the subjective attributes, hue and saturation, by giving the dominant wave length and the excitation purity.

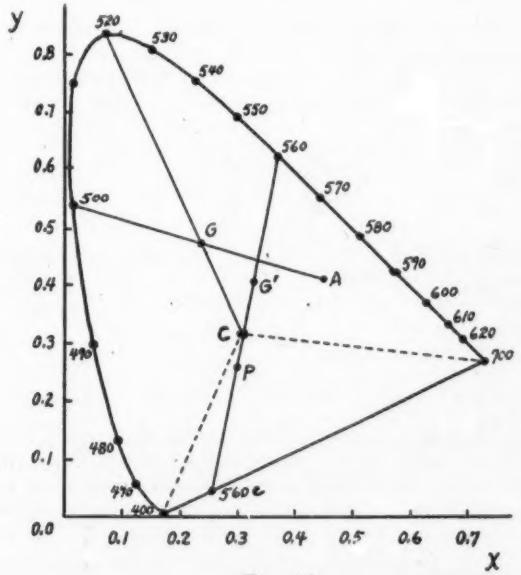

Fig. 10

Indirect Colorimetry

The mechanism is now available for the specification of color without recourse to the difficulties and uncertainties of direct visual colorimetry. Before the I.C.I. standards were set up in 1931, the reliability of tristimulus distribution data was too uncertain to warrant its extensive use. Since the acceptance of the averaged distribution functions defining the I.C.I. standard observer, it has become feasible to use photometric data and calculate color specifications, average tristimulus values, which would be obtained by the standard observer were he to use a colorimeter and examine the same samples.

A typical calculation of the tristimulus specification of a color may be sketched in the following way. Let *E* be the spectral energy distribution of the illuminant, say I.C.I. illuminant *C*. Let *R* be the spectral reflectance of the sample. The value of *ER* at a wave length of 500 millimicrons, for example, gives the relative intensity of the light of wave lengths between 499.5 and 500.5 millimicrons that is reflected by the sample when viewed under illuminant *C* with a specified geometry of illuminating and viewing, i.e., the products *ER* give the spectral distribution of the reflected light for the given situation. Reverting to psychophysical nomenclature, the products give the spectral distribution of the stimuli reaching the eye of the observer. It will be remembered that the tristimulus distribution functions, *U*, *V*, and *W*, give the relative amounts of the I.C.I. primaries that the standard observer would use to match unit intensity of the spectrum colors, i.e., the value of *U* at 450 millimicrons is the amount of the corresponding primary that the standard observer would use to match unit intensity of light wave lengths between 449.5 and 450.5 millimicrons. If the intensity of the stimulus, light, is *ER*, instead of unity, the amount of the primary needed by the standard observer would be *ERU*, instead of *U*. As has been explained earlier, if the wave length interval is *a* millimicrons instead of one millimicron, the amount of the primary needed is *aERU*.

The visible spectrum is divided into wave length intervals of 5 millimicrons and the products 5*ERU*, 5*ERV*, and 5*ERW* are calculated for the wave length at the center of each interval, and the various values tabulated in three columns. The sum of each column is a measure of the amount of the corresponding primary that the standard observer would use in matching the color of the light reflected to his eye, i.e., the sums are proportional to the corresponding tristimulus values. The criterion for proper width of the interval used in calculating these sums corresponds to that given in the paragraph on calculation of luminosities. For many samples 10-millimicron intervals are satisfactory, for others 5-millimicron or smaller intervals are necessary.

The sums are proportional to the tristimulus values, rather than equal to them, as the relative, rather than the absolute, spectral energy distribution of the illuminant was used in the calculation. However, the relative spectral energy distribution *E* is adjusted by a constant so chosen that the tristimulus *Y*

value is the visual efficiency; the trichromatic coefficients are obtained as previously described.

SECTION VII

Three-filter Colorimeters[10]

Photoelectric instruments called colorimeters, color analyzers, or any other name suggesting color specification, are improperly and deceivingly named unless they yield scale readings that can be interpreted in terms of tristimulus values. The lure of such instruments lies in the obvious convenience that would result from objectively obtaining instrument readings that specify a color, as opposed to the relative inconvenience of the rigors of visual colorimetry and of the calculations of indirect colorimetry.

The critical features of the various methods of measuring spectral reflectance and spectral transmittance have been discussed in Section IV and Section V, and it is assumed that the instruments discussed here satisfy the appropriate requirements laid down in those sections. In this section the discussion will be limited to the peculiar spectral characteristics demanded of an instrument that may be properly designated a photoelectric colorimeter, and to the possible fields of usefulness of *actual* three-filter instruments.

The Ideal Photoelectric Colorimeter

The spectral characteristics required of an ideal photoelectric colorimeter may be introduced as follows. A sample and a reflectance standard are successively measured in the colorimeter with each of the three filters r, g, and b, in turn. The readings obtained are, respectively, i_r, i_g, and i_b, for the sample, and I_r, I_g, and I_b, for the reflectance standard. As was emphasized in Section VI, a specification of the color of a sample has meaning only for a particular illuminant. The illuminant for which the instrument is to specify the color of the sample must then be selected.

Let

- E be the relative spectral energy distribution of the illuminant for which the specification of color is desired, say illuminant C.
- E' be the relative spectral energy distribution of the light source in the instrument.
- T_r, T_g, T_b be the spectral transmittances of the three filters in the instrument.
- S be the spectral response of the photo-cell in the instrument.
- R be the unknown spectral reflectance of the sample.
- R_o be the known spectral reflectance of the reflectance standard.
- U, V, and W be the tristimulus distribution functions.
- C_r, C_g, and C_b are constants.

The *condition* that the instrument readings be relative tristimulus values is then given by the following equations:

$$\begin{aligned} ERU &= C_gE'T_rRS, \\ ERV &= C_gE'T_gRS, \\ ERW &= C_bE'T_bRS, \end{aligned} \tag{1}$$

for the sample, and

$$\begin{aligned} ER_oU &= C_rE'T_rR_oS, \\ ER_oV &= C_gE'T_gR_oS, \\ ER_oW &= C_bE'T_bR_oS, \end{aligned} \tag{2}$$

for the reflectance standard.

ER_oU, for example, is the relative tristimulus value of the reflectance standard when viewed under monochromatic light from illuminant C by the I.C.I. standard observer. [Each of the six equations in (1) and (2) are functions of the wave length]. This relative tristimulus value must be proportional to the photocell current, due to monochromatic light of the same wave length emitted from the light source, transmitted by filter r, reflected by the standard, and incident on the photocell.

The wave length range of the visible spectrum is divided into intervals of suitable wave length width, as discussed in earlier sections.[12] The indicated products of (2) are calculated for each interval, multiplied by the width of the interval, and listed in appropriate columns. The sums of the columns ERU, ERV, and ERW are proportional, respectively, to the relative tristimulus values X_o, Y_o, and Z_o, for the reflectance standard. The sums of the columns $C_rE'T_rRS$, etc., are proportional, respectively, to the photocell currents I_r, I_g, and I_b, for the reflectance standard. From equations (2) it follows that:

$$\begin{aligned} X_o &= aI_r, \\ Y_o &= aI_g, \\ Z_o &= aI_b. \end{aligned}$$

Similar relationships must exist for the unknown tristimulus values of the sample:

$$\begin{aligned} X &= ai_r, \\ Y &= ai_g, \\ Z &= ai_b. \end{aligned}$$

Thus, if the color specification of the standard of reflectance is known, either from direct visual colorimetry or from the calculations of indirect colorimetry, the color specification of the sample is given by the photoelectric colorimeter as

$$\begin{aligned} X/X_o &= i_r/I_r, \\ Y/Y_o &= i_g/I_g, \\ Z/Z_o &= i\ /I_b, \end{aligned} \tag{3}$$

where X, Y, and Z are the relative tristimulus values sought, X_o, Y_o, and Z_o are the ***known*** tristimulus values of the reflectance standard, and i_r, i_g, i_b, I_r, I_g

$$\int_o^\infty E \cdot R_o \cdot U \cdot d\lambda = C_r \int_o^\infty E' \cdot T_r \cdot R_o \cdot S \cdot d\lambda = X_o = aI_r,$$

where a is a proportionality constant (an instrumental constant).

and I_b are the ***known*** instrumental readings. These relative tristimulus values may be replaced by trichromatic coefficients and luminous efficiencies as discussed in the last section. The solution of equa-

[11] In connection with this section the reader will be interested in reading:

(a) Gibson, K. S. Photoelectric "colorimeters". National Bureau of Standards Letter Circular, LC-473.

(b) Guild, J. The instrumental side of colorimetry. Journal of Scientific Instruments 11: 76 (1934).

[12] As explained earlier, this division into wave length intervals, calculation of products, and summation is merely a practical means of evaluating the integrals resulting from the integration of equations (2), e.g.,

tions (1) or (2) for the transmittances of the filters yields

$$T_r = EU/C_rE'S,$$
$$T_g = EV/C_gE'S, \qquad (4)$$
$$T_b = EW/C_bE'S,$$

which gives the transmittances in terms of the spectral characteristics of the viewing illuminant, the light source, the response of the photocell, and the tristimulus distribution functions. The colorimetry section of the National Bureau of Standards has calculated these ideal filter transmittances for the cases of several common blocking-layer photocells, assuming illuminant *C* to be used for viewing, and illuminant *A* to be the light source of the instrument. Those data show the ideal filters (*r*, *g*, and *b*) to be yellow, green, and blue, instead of the popularly imagined red, green, and blue.

Actual Instruments Approximating the Ideal Photoelectric Colorimeter

In practice, filters having the characteristics demanded by equations (1) are not available. Even though such filters were available, it is doubtful if their spectral characteristics, combined with those of the light source and photocell, would remain fixed long enough to be useful in a practical instrument.

The ideal *r* filter is the most difficult to match. Approximations to the ideal *g* and *b* filters are known for certain types of photocells, but no, even approximate, match over the entire necessary range of wave lengths is known for *r*.

Consideration of equations (1) and of Fig. 7 suggest that the ideal *r* filter should have spectral charteristics roughly *similar* to those of the ideal *b* filter for wave lengths less than about 505 millimicrons and should have a second maximum near 600 millimicrons. The calculations carried out at the Bureau of Standards bear out this influence. Hence, if a filter can be found whose spectral transmittance approaches that of the ideal *r* filter for the range above 505 millimicrons and is zero below that range, an approach to the ideal situation can be made by having the actual *b* filter do double duty, i.e., the reading with the actual *r* (hereafter called *r'*) filter is taken and to that is added the properly weighted reading with the actual *b* filter. The sum is the effective *r* reading. The actual *g* and *b* readings are taken in the normal fashion. The weighting factor[13] for the *b* reading is a function of *E* and R_o, as well as of *E'*, *R*, *S*, T_r, and T_b. The first of equations (3) becomes, for this case,

$$X/X_o = (i_r' + ni_b)/(I_r' + nI_b).$$

Usefulness of Three-filter Instruments

The usefulness of an actual instrument will depend on the nearness of its approach to the ideal discussed above. An instrument using filters as similar as possible to the ideal ones and making use of a combined *r'* and *b* reading, as sketched, may be satisfactory for the specification of *some* colors. Guild[11] gives data on the performance of one such instrument. For control work in matching colors, such an instrument might prove useful for a considerable range of colors, but it must be borne in mind that it would match the colors for only one illuminant.

On the other hand, an instrument is of no use in specifying color if its filters are chosen merely because they are red, green, and blue, and because they transmit sufficient energy to produce a useful deflection of the indicating meter. Neither is such an instrument of any use in comparing, or matching, the colors of samples unless the spectral reflectances (or transmittances) of the samples bear a constant ratio to each other at all wave lengths, i.e., unless the spectral reflectance (or transmittance) curve of one sample can be obtained by multiplying the ordinates of the curve of the second sample by a constant factor. In such a case, the three filters are merely a convenience, permitting one to choose the filter giving the best sensitivity for the measurement of the relative visual efficiency of the samples, which is all the comparison then amounts to. There are any number of spectral reflectance curves, and, therefore, any number of colors, for which a three-filter instrument of this random type would yield identical sets of scale readings.

It is particularly important, when considering this type of instrument, to distinguish between reproducibility of the instrument readings and their meaning. The fact that an instrument yields reproducible readings should not be used to predicate the conclusion that the readings are a true measure of the desired quantity.

Three-filter Instruments as a Tool in Chemical Analysis

It is felt that too much emphasis is attached to color when three-filter instruments are used to measure concentrations of solutions. As has been emphasized throughout this report, color is a function of the illuminant used in viewing the sample. The quantity of fundamental importance in analyses of this sort is the spectral absorption coefficient of the solution. That quantity is characteristic of the solution under any illuminant. The measurement or comparison of spectral transmittance, from which the spectral absorption coefficient can be calculated, should then be the aim of such analyses.

The filters most appropriate for the analysis, or the control, of particular solutions will depend on the spectral transmittance of the solutions. No three filters will prove satisfactory for the analysis of all solutions, for as pointed out in Sections IV and V, the spectral transmittance curve of a sample cannot be inferred from three points. Therefore, the filter, or filters, should be so chosen that their effective wave lengths fall in critical regions of spectral transmittance curve of the solutions at hand. Filters chosen for true *colorimetric* purposes must transmit broad spectral regions, while filters for analytical purposes should transmit spectral regions as narrow as possible. Therefore, instruments intended to be *colorimeters* will not, in general, be suitable for analysis unless accessory filters are used.

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[12] $$n = \int_{400}^{505} E'RST_r d\lambda \Big/ \int_{400}^{505} E'RST_b d\lambda$$

The weighting factors given on page 14 of Bureau of Standards Letter Circular, LC-473 are correct for an ideal reflector (magnesium oxide) viewed under an equal-energy illuminant. In general these factors are a function of the illuminant and of the standard. The actual weighting factors should be, respectively,

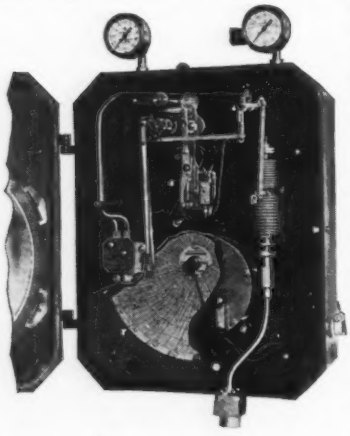
$$\alpha = \int_{505}^{700} ET_x Rosd\lambda \Big/ \int_{400}^{700} ET_x Rosd\lambda \quad (\neq 0.83 \text{ in general}), \text{ and}$$

$$\beta = \int_{400}^{505} ET_x Rosd \Big/ \int_{400}^{700} ET_x Rosd\lambda \quad (\neq 0.17 \text{ in general}).$$

The nomenclature in these last two equations is that of LC-473.

Absolute-Pressure Instruments

The critical relationship which exists between absolute pressure and the physical properties of gases and vapors under low pressure is too frequently ignored. Unless fluctuations in barometric pressure are considered, errors in measurement and serious variations in processing may result from the apparently negligible discrepancy. Advanced engineering practice specifies the absolute-pressure system for low pressure measurement.



Complying with this technological advancement, the Taylor Instrument Companies, Rochester, N. Y., have just announced a new line of instruments for indicating, recording and controlling absolute pressure.

The absolute pressure element consists of a flexible phosphor-bronze bellows to the inside of which the pressure medium under measurement is communicated. Connected with this assembly, and opposing its action, is a second identical metal bellows which has been evacuated and sealed, thus comprising an atmospheric-pressure compensator.

These instruments are applicable to distillation units, evaporators, condensers, and in general, wherever the corresponding mercury type of gauges can be used—with the exception, of course, of gases or vapors corrosive to the bronze bellows.

Paper mill applications include section box headers, section couch rolls, section press rolls, supply and condensate heads; and evaporators in sulphate pulp mills.

Ceases Finnish Representation

Hans Lagerloef, president and treasurer of the Lagerloef Trading Company, has issued the following announcement which explains itself;

"The Lagerloef Trading Company, Inc., of 52 Vanderbilt avenue, New York City, for many years has had the honor of being the American representative of the Finnish Cellulose Association and the Finnish Wood Pulp Union, both of Helsingfors, Finland. The corporation points with considerable pride to its record of accomplishment on behalf of the Finnish associations from the days of inconsequential Finnish pulp tonnage imports into the United States to the present definitely large and well-established market for Finnish pulps.

"The time has now arrived when the Lagerloef Trading Co., Inc., must announce that it will cease to represent the Finnish Cellulose Association as of December 1, 1937, save for the completion of certain contracts.

"The Lagerloef Trading Company, Inc., also announces that it will cease to represent the Finnish Wood Pulp Union as of February 1, 1938, save also for the completion of certain contracts.

"The Lagerloef Trading Company, Inc., trusts that the kindly and hearty support which it has been accorded by the American paper and pulp industries will be extended to the Finnish Cellulose Association and Finnish Wood Pulp Union.

"It is the intention and aim of the Lagerloef Trading Company, Inc., to continue its efforts in the field of pulp distribution in the United States. The destinies of the corporation will continue to be guided, as heretofore, by its president, Mr. Hans Lagerloef.

"Mr. Hans Lagerloef wishes to express his deepest appreciations of the past courtesies, kindnesses and cooperation which have been accorded him personally by the American paper and pulp industries and it is his hope that this same sympathetic cooperation and generous support will continue to afford him an inspiration for his further efforts."

Pulp Sales Corp. Formed

The Finnish Cellulose Association of Helsingfors, Finland, through its managing director, Walter Gräsback, has issued the following self-explanatory announcement:

"We take pleasure in announcing the organization of Pulp Sales Corporation, with offices at 230 Park avenue, New York, N. Y. Commencing December 1, 1937, this corporation will be the sole representative for the United States and Mexico of the Finnish Cellulose Association, Helsingfors, Finland. The officers of the organization will be E. E. Barrett, president; E. Erickson, vice president; V. Ramsay, secretary-treasurer.

"During the past eighteen years our interests have been successfully taken care of by Lagerloef Trading Company, Inc., New York City, and the development of our trade in the United States is largely to be attributed to the policy of high ideals pursued by that company.

"Pulp Sales Corporation will commence its activity along the same lines, maintaining this record of integrity. Unexpired contractual commitments of the Finnish Cellulose Association will be carried out through the Corporation, with the exception, however, that shipments up to the end of 1937 will be handled by Lagerloef Trading Company.

"We are anxious to assure our customers that they will receive the same efficient and satisfactory service as heretofore."

Correction

Owing to a typographical error, it was stated in the issue of the Paper Trade Journal, of September 30, 1937, that the volume entitled Books and Documents (Dating, Permanence and Preservation), published by Grafton & Co., London, England, contained but 21 pages. This was an error, as the book contains 218 pages.

Law and Stepberger Make Mill Tour

Wm. C. Law, general superintendent, of the S. Austin Bicking Paper Manufacturing Company, Downingtown, Pa. and Joseph Stepberger, superintendent of the Ravenswood Paper Mill Company, Long Island City, N. Y., have returned from an interesting tour of the paper mills in New Jersey, New York and Connecticut.

Imports of Paper and Paper Stock

Giving Manifests of New York, Boston, Philadelphia and Other Ports, of Newsprint, Wrapping, Writing, Coated, Blotting, Tissue, Strawboard, Wallboard, Cigarette Papers, Sulphite, Kraft and Ground Wood Pulp.

NEW YORK IMPORTS
WEEK ENDING OCTOBER 30, 1937
SUMMARY

Cigarette Paper .....775 cs.
Wall Paper .....46 bxs., 7 cs.
Paper Hangings .....9 bls., 2 cs.
Newsprint .....11,396 rolls, 12 pkgs.
Printing Paper .....61 cs., 1 crate
Wrapping Paper .....1,189 rolls, 199 bls., 15 cs.
Filter Paper .....11 cs.
Surface Baryta Coated Paper .....42 cs., 52 crates
Surface Coated Paper .....25 cs.
Metal Coated Paper .....25 cs.
Photo Paper .....41 cs.
Tissue Paper .....6 cs.
Colored Paper .....6 cs.
Stencil Paper .....2 cs.
Silk Paper .....134 bbls., 2 cs.
Gummed Paper .....4 cs.
Writing Paper .....15 cs.
Miscellaneous Paper .....401 rolls, 54 cs.

CIGARETTE PAPER

Champagne Paper Corp., *Ile de France,* Havre, 421 cs.
De Manduit Paper Corp., *Ile de France,* Havre 2 cs.
De Manduit Paper Corp., *Manhattan,* Havre, 175 cs.
R. J. Reynolds Tobacco Co., *Manhattan,* Havre, 175 cs.

WALL PAPER

S. K. Lonegrean, *Gripsholm,* Gothenburg, 46 bxs.
——, *Manhattan,* Havre, 7 cs.

PAPER HANGINGS

W. H. S. Lloyd & Co., *Georgic,* London, 9 bls., 2 cs.

NEWSPRINT

H. G. Craig Co., *Donpaco,* Donnacona, 317 rolls.
Gilman Paper Co., *Malaren,* Hallstavik, 666 rolls.
Brooklyn Daily Eagle, *Malaren,* Hallstavik, 557 rolls.
N. Y. Evening Journal, *Malaren,* Norrkoping, 1,450 rolls.
Jay Madden Corp., *Bremen,* Bremen, 178 rolls.
——, *Stavangerfjord,* Oslo, 476 rolls.
——, *Stavangerfjord,* Skien, 309 rolls, 12 pkgs.
International Paper Co., *International No. 1,* Gatineau, 305 rolls.
Jay Madden Corp., *Pr. Roosevelt,* Hamburg, 473 rolls.
Perkins Goodwin & Co., *Pr. Roosevelt,* Hamburg, 219 rolls.
Daily Mirror, Inc., *Sydfold,* Quebec, 2,228 rolls.
International Paper Sales Co., *Ogontz,* Dalhousie, 2,851 rolls.
International Paper Co., *Ogontz,* Dalhousie, 1,146 rolls.
Jay Madden Corp., *Svaneholm,* Kotka, 556 rolls.
Jay Madden Corp., *New York,* Bremen, 365 rolls.
Perkins Goodwin & Co., *New York,* Hamburg, 71 rolls.
H. G. Craig Co., *Kermic,* Donnacona, 338 rolls.

PRINTING PAPER

L. A. Consmiller, *Bremen,* Bremen, 29 cs.
Keuffel & Esser Co., *Manhattan,* Hamburg, 1 crate.
S. Dietzgen & Co., *New York,* Hamburg, 32 cs.

WRAPPING PAPER

Lunham & Reeve, *Gripsholm,* Gothenburg, 44 bls., 1,098 rolls.
H. Reeve Angel & Co. Inc., *Gripsholm,* Gothenburg, 91 rolls.
Sandvik Steels, Inc., *Gripsholm,* Gothenburg, 1 cs.
Japan Paper Co., *Gripsholm,* Gothenburg, 155 bls.
F. C. Strype, *Black Tern,* Antwerp, 1 cs.
H. Reeve Angel & Co. Inc., *Black Tern,* Antwerp, 4 cs.
Steiner Paper Corp., *New York,* Hamburg, 9 cs.

PACKING PAPER

A. J. Bullinger, *Black Heron,* Rotterdam, 6 cs.

KRAFT PAPER

——, *Malaren,* Norrkoping, 26 rolls.

FILTER PAPER

H. Reeve Angel & Co. Inc., *Georgic,* London, 9 cs.
——, *Samaria,* Liverpool, 2 cs.

SURFACE BARYTA COATED PAPER

L .A. Consmiller, *Bremen,* Bremen, 27 cs.
L. A. Consmiller, *New York,* Bremen, 15 cs.
Globe Shipping Co., *New York,* Bremen, 52 crates.

METAL COATED PAPER

K. Pauli Co., *New York,* Bremen, 20 cs.

SURFACE COATED PAPER

C. Happel, *New York,* Hamburg, 4 cs.
Phoenix Shipping Co., *New York,* Hamburg, 1 cs.
C. Happel, *Manhattan,* Hamburg, 10 cs.
Moller Kokeritz & Co., *New York,* Bremen, 10 cs.

PHOTO PAPER

Gevaert Co. of America, *Pennland,* Antwerp, 33 cs. (unfinished).
J. J. Gavin & Co., Aquitania, Southampton, 8 cs. (unsensitized).

TISSUE PAPER

B. F. Drakenfeld & Co., *Samaria,* Liverpool, 6 cs.

COLORED PAPER

International F'd'g. Co., *New York,* Hamburg, 6 cs.

STENCIL PAPER

——, American Banker, London, 2 cs.

SILK PAPER

Jay Madden Corp., *Manhattan,* Hamburg, 134 bbls., 2 cs.

GUMMED PAPER

——, *American Banker,* London, 4 cs.

WRITING PAPER

——, *Manhattan,* Hamburg, 15 cs.

PAPER

The Borregaard Co. Inc., *Gripsholm,* Gothenburg, 92 rolls.
Chase National Bank, *Gripsholm,* Gothenburg, 240 rolls.
E. H. Sergent & Co., *Gripsholm,* Gothenburg, 25 cs.
F. L. Kramer & Co., *Gripsholm,* Gothenburg, 219 bls.
Standard Products Corp., *Amagisan Maru,* Yokohama, 14 cs.
Keuffel & Esser Co., *Manhattan,* Hamburg, 69 rolls.
F. C. Strype, *New York,* Hamburg, 15 cs.

RAGS, BAGGINGS, ETC.

W. J. Green, *Fernhill,* Algiers, 103 bls. rags.
E. J. Keller, Co. Inc., *Black Heron,* ——, 114 bls. bagging.
Castle & Overton, Inc., *Black Heron,* Rotterdam, 228 bls. bagging.
E. J. Keller Co. Inc., *Pennland,* ——, 73 bls. bagging.
Hughes Fawcett, Inc., *Pennland,* Antwerp, 8 bls. flax waste.
——, *American Banker,* London, 28 bls. rags, 14 bls. paper stock.
Irving Trust Co., *Cameronia,* Glasgow, 42 bls. paper stock.
——, *Amagisan Maru,* Kobe, 400 bls. cotton waste.
Van Oppen & Co., *Black Tern,* Antwerp, 79 bls. jute waste, 15 bls. rags.
Loumar Textile By Products, *Black Tern,* Antwerp, 140 bls. bagging.
W. J. Green, *Black Tern,* Antwerp, 138 bls. flax thread waste.
Irving Trust Co., *Black Tern,* Antwerp, 65 bls. bagging.
Banco Coml. Italiane Trust Co., *Black Tern,* Rotterdam, 15 bls. bagging.
——, *Vincent,* Havre, 27 bls. rags.
Van Oppen & Co., *Vincent,* Havre, 100 bls. bagging.
American Express Co., *Vincent,* Havre, 62 bls. rags.
W. J. Green, *Vincent,* Havre, 50 bls. rags.
E. J. Keller Co. Inc., *Vincent,* ——, 10 bls. rags.
——, *Exermont,* Genoa, 156 bls. bagging, 296 bls. rags.
Hicks Costarino & Co., *Exermont,* Naples, 158 bls. rags.
——, *Exermont,* Naples, 154 bls. rags.
Keene, Inc., *Exermont,* Naples, 91 bls. bagging.
W. Steck & Co., *Exermont,* Naples, 163 bls. bagging.
D. Benedetto, Inc., *Exermont,* Naples, 149 bls. rags.
E. J. Keller Co. Inc., *Exermont,* ——, 129 bls. rags, 61 bls. bagging.
E. J. Keller Co. Inc., *Exeter,* ——, 35 bls. bagging.
J. Levy & Son, *Oriente,* Havana, 16 bls. rags.
Irving Trust Co., *New York,* Hamburg, 24 bls. old canvas.
——, *New York,* Hamburg, 133 bls. bagging.

OLD ROPE

Banco Coml. Italiane Trust Co., *Georgic,* London, 43 coils.
Banco Coml. Italiane Trust Co., *American Banker,* London, 104 bls.
Irving Trust Co., *Cameronia,* Glasgow, 33 coils, 65 bls.
W. Steck & Co., *Edam,* Rotterdam, 46 coils.

CHINA CLAY

English China Clays Sales Corp., *Gloucester City,* Fowey, 53 tons, 8 cwt., in bulk.
English China Clays Sales Corp., *Gloucester City,* Fowey, 1,825 bags.
Moore & Munger, *Gloucester City,* Fowey, 1,466 tons, 19 cwt., in bulk.

CASEIN

——, *Ile de France,* Havre, 200 bags.

WOOD PULP

——, *Innaren,* Sweden, 4,410 bls. sulphate, 1,800 bls. sulphite.
Brown Bros. Harriman & Co., *Innaren,* Sweden, 4,800 bls. sulphite, 6243 bls. sulphate.
Perkins Goodwin & Co., *Gripsholm,* Gothenburg, 150 bls. sulphite.
Perkins Goodwin & Co., *Gripsholm,* Gothenburg, 140 bls. sulphate.
Pulp Specialties, Inc., *Gripsholm,* Gothenburg, 7 bls. sulphate.
Lagerloef Trading Co., *Malaren,* Viipuri, 1575 bls. sulphite.
E. M. Sergeant Pulp & Chemical Co., *Stavangerfjord,* Nygard, 300 bls. chemical pulp.
——, *Stavangerfjord,* Oslo, 720 bls. sulphite.
Irving Trust Co., *Stavangerfjord,* Oslo, 325 bls. mechanical pulp.
The Borregaard Co. Inc., *Stavangerfjord,* Sarpsborg, 1,380 bls. sulphate.
Guaranty Trust Co., *Pr. Roosevelt,* Hamburg, 498 bls. wood pulp, 99 tons.
Lagerloef Trading Co., *Svaneholm,* Rauma, 1,220 bls. sulphate, 2,435 bls. sulphite.
Bulkley Dunton Pulp Co. Inc., *Svaneholm,* ——, 750 bls. sulphate.
——, *New York,* Hamburg, 1,000 bls. wood pulp, 150 tons.

WOOD PULP BOARDS

H. Fuchs & Son, *Gripsholm,* Gothenburg, 175 crates.
Fibre Case & Novelty Co., *Gripsholm,* Gothenburg, 40 bls.
Jay Madden Corp., *Svaneholm,* Viipuri, 95 bls.
Jay Madden Corp., *Svaneholm,* Kotka, 61 rolls, 138 bls.

ALBANY IMPORTS

WEEK ENDING OCTOBER 30, 1937

Castle & Overton, Inc., *Malaren,* Viipuri, 2,084 bls. wood pulp.
Lagerloef Trading Co., *Malaren,* Viipuri, 5,053 bls. sulphite, 504 bls. sulphate.

PORTLAND IMPORTS

WEEK ENDING OCTOBER 30, 1937

Price & Pierce, Ltd., *Innaren,* Hernosand, 600 bls. unbleached sulphite.
Price & Pierce, Ltd., *Innaren,* Hernosand, 750 bls. unbleached sulphate.
Price & Pierce, Ltd., *Milos,* ——, 750 bls. unbleached sulphate.
Price & Pierce, Ltd., *Milos,* ——, 300 bls. unbleached sulphite.
Price & Pierce, Ltd., *Uddeholms,* ——, 2,052 bls. unbleached sulphite.
Price & Pierce, Ltd., *Uddeholms,* ——, 2,880 bls. unbleached sulphate.
J. Andersen, & Co., *Innaren,* Sundsvall, 9,960 bls. sulphate.
Johaneson Wales & Sparre, Inc., *Innaren,* Sundsvall, 300 bls. sulphate.

BOSTON IMPORTS

WEEK ENDING OCTOBER 30, 1937

Irving Trust Co., *Black Tern,* Antwerp, 52 bls. bagging.
——, *Black Tern,* Antwerp, 98 bls. rags.
Castle & Overton, Inc., *Black Tern,* Rotterdam, 200 bls. wood pulp, 40 tons.
Price & Pierce, Ltd., *Svanhild,* ——, 500 bls. bleached sulphite.
Parsons & Whittemore, Inc., *Quaker City,* ——, 722 bls. wood pulp.
Parsons & Whittemore, Inc., *Artigas,* ——, 279 bls. wood pulp.

NEW LONDON IMPORTS

WEEK ENDING OCTOBER 30, 1937

Gottesman & Co. Inc., *Uddeholms,* Sweden, 3,000 bls. sulphate.
Price & Pierce, Ltd., *Uddeholms,* Sweden, 150 bls. unbleached sulphate, 900 bls. unbleached sulphite.

PHILADELPHIA IMPORTS

WEEK ENDING OCTOBER 30, 1937

W. J. Green, *Fernhill,* Algiers, 150 bls. rags.
Castle & Overton, Inc., *Black Heron,* Rotterdam, 101 bls. rags.
Castle & Overton, Inc., *Black Heron,* Antwerp, 216 bls. rags.
Philadelphia National Bank, *Black Heron,* Antwerp, 165 bls. rags.
Philadelphia Inquirer, *Malaren,* Hallstavik, 503 rolls newsprint.
E. H. Bailey & Co., *Vincent,* Havre, 1 cs. drawing paper.
Castle & Overton, Inc., *Vincent,* Havre, 273 bls. rags.
E. J. Keller Co. Inc., *Vincent,* ——, 227 bls. rags.
Castle & Overton, Inc., *Svaneholm,* Viipuri, 1,008 bls. wood pulp.
Lagerloef Trading Co., *Svaneholm,* Viipuri, 2,887 bls. sulphite.
Lagerloef Trading Co., *Svaneholm,* Viipuri, 500 bls. sulphate.
Wilkinson Bros. & Co. Inc., *Svaneholm,* Kotka, 91 rolls newsprint.
J. W. Hampton Jr. & Co., *Svaneholm,* Kotka, 411 rolls newsprint.
Jay Madden Corp., *Svaneholm,* Kotka, 172 bls., 48 rolls wood pulp boards.
Bulkley Dunton Pulp Co Inc., *Svaneholm,* ——, 250 bls. sulphite, 1,875 bls. sulphate.
Gottesman & Co. Inc., *Uddeholm,* Sweden, 2,850 bls. sulphite, 5,403 bls. sulphate.
Price & Pierce, Ltd., *Uddeholm,* Sweden, 300 bls. unbleached mechanical pulp.

WILMINGTON IMPORTS

WEEK ENDING OCTOBER 30, 1937

Castle & Overton, Inc., *Svaneholm,* Viipuri, 3,261 bls. wood pulp.
Lagerloef Trading Co., *Svaneholm,* Kotka, 1,040 bls. mechanical pulp.
Lagerloef Trading Co., *Svaneholm,* Rauma, 5,030 bls. sulphite.
Price & Pierce, Ltd., *Ginnheim,* ——, 7,340 bls. unbleached sulphite.

BALTIMORE IMPORTS

WEEK ENDING OCTOBER 30, 1937

English China Clays Sales Corp., *Gloucester City,* Fowey, 316 tons, 4 cwt. china clay, in bulk.
English China Clays Sales Corp., *Gloucester City,* Fowey, 1,026 bags china clay, 54 tons.
English China Clays Sales Corp., *Gloucester City,* Fowey, 25 casks china clay, 2 tons, 10 cwt.
Moore & Munger, *Gloucester City,* Fowey, 1,208 tons, 13 cwt., china clay, in bulk.
Congoleum Nairn Co., *Exermont,* Marseilles, 352 bls. rags.
Price & Pierce, Ltd., *Milos,* ——, 4,800 bls. unbleached sulphite.
Price & Pierce, Ltd., *Gunnheim,* ——, 3,954 bls. unbleached sulphite.
Gottesman & Co. Inc., *Gunnheim,* Sweden, 500 bls. sulphite, 1,375 bls. sulphate.

NORFOLK IMPORTS

WEEK ENDING OCTOBER 30, 1937

Gottesman & Co. Inc., *Gunnheim,* Sweden, 3,625 bls. sulphite.
Price & Pierce, Ltd., *Gunnheim,* ——, 5480 bls. unbleached sulphite.

NEW ORLEANS IMPORTS

WEEK ENDING OCTOBER 30, 1937

Parsons & Whittemore, Inc., *Frakenwald,* ——, 295 bls. wood pulp.

MONTREAL IMPORTS

WEEK ENDING OCTOBER 30, 1937

Gottesman & Co. Inc., *Vasaholm,* Sweden, 4,800 bls. sulphate.
Gottesman & Co. Inc., *Vasaholm,* Sweden, 6,780 bls. sulphite.

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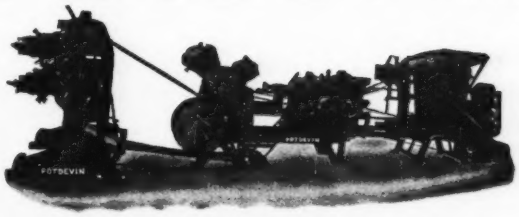

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New York Market Review

Office of the PAPER TRADE JOURNAL,
Wednesday, November 3, 1937.

The demand for paper in general is stated by the wholesale markets as moderate. Little change in sales volume is reported for the week. The opinion still prevails in the trade that stocks in jobber and consumer hands are so limited that normal buying should soon begin to replenish depleted stocks. Contract prices throughout the paper markets hold firm, with slightly lower quotations reported, here and there, on spot orders.

The newsprint market continues active, with a normal movement of contract shipments.

The fine paper market reports demand on about the moderate level of the preceding week. Book papers are also moderately active, while conditions in the writing paper market are stated to be somewhat improved.

Kraft papers are moderately active but little improvement is reported in the box board market. An improvement in consumer demand is reported here and there, but the activity of the box board market is still below seasonal and is relatively quiet.

Chemical Pulp

The chemical pulp market is comparatively quiet. Prices are on about the level of last week, with some expectations of a slight decline in prices and a light recession in demand for so-called spot tonnage. The decline in the production of kraft paper and board are the adverse factors.

Mechanical Pulp

No change is reported in the mechanical pulp market. Prices for the current week continue firm, with demand only slightly under that of last week.

Old Rope and Bagging

The old rope and bagging market are unchanged. Demand for domestic bagging is quiet and prices remain at prevailing levels. The old rope market is also quiet, with no change in prices reported.

Rags

The domestic rag market continues relatively quiet. No noteworthy changes in prices are reported. The foreign rag market is inactive.

Waste Paper

The waste paper market reports prices of the higher grades as relatively firm, with some slight declines in the prices of the lower grades.

Twines

The twine market is relatively quiet. Demand is about on the level of last week. Prices are unchanged.

Indianapolis Demand Is Fair

[FROM OUR REGULAR CORRESPONDENT]

INDIANAPOLIS, Ind., November 2, 1937—Only a fair demand for paper was reported during the last week enhancing the sluggishness that has been current during a month or more. The situation seems to apply to all grades, even newsprint movement on contracts having slowed up slightly. All prices seem to be firmly held, however, and there apparently is no disposition on the part of manufacturers or jobbers either to attempt to force business via the old medium of price slashing. Credit conditions remain good and the undertone of the entire market is firm. Many executives believe the current condition is but a temporary one and that the entire business is on a stronger basis than it was this time a year ago.

The lateness of the fall season doubtless had much to do with the poor demand for fine papers. Much advertising was held up permanently, the season being so late that some of this material will be changed to apply to the holiday season. Printers now are closing some direct by mail business and covers and book papers likely will show some life during the next two weeks.

Demand for building papers and roofing has dropped slightly but there is still activity and will be until severe weather effectually stops outside construction. Demand for summer specialties is over and retailers cleaned up their stocks in good shape. There is a continued demaand for tissues and towels, however.

Box factories report only fair business with some call coming for Holiday specialties. The box board market is a trifle off, but prices are being well held. Production at the factories in this state has been curtailed. Kraft papers are holding their own and some jobbers are expecting an increase shortly. Demand for bags is fair with prices steady.

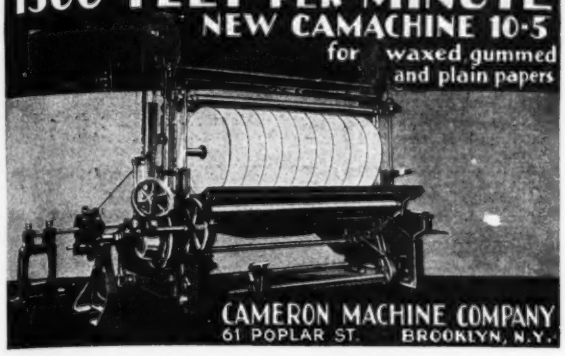
A moderate demand is seen for rags and waste paper. The demand seems to center about the better grades of each with prices on these holding firm, but some price weakness shown in poorer grades.

Resume Operations at Ft. Edward

[FROM OUR REGULAR CORRESPONDENT]

FORT EDWARD, N. Y., October 30, 1937—Operations were resumed here early this week at the local branch of the International Paper Company after a shutdown caused by the burning out of two large transformers weighing several tons each. Operations were halted for about twenty-four hours. The mill is running with a near normal working force.

1500 FEET PER MINUTE
NEW CAMACHINE 10-5
for waxed gummed and plain papers



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Improve the quality of your product by using Langston Shear-Cut Slitters which slice the paper cleanly from start to finish of the roll.

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Miscellaneous Markets

Office of the PAPER TRADE JOURNAL,
Wednesday, November 3, 1937.

BLANC FIXE—The blanc fixe market continues steady. Prices are firm and unchanged. Quotations of pulp range at from $42.50 to $45 per ton, in bulk. The powder is quoted at from 3½ to 3¾ cents per pound, in barrels, at works.

BLEACHING POWDER—The demand for bleaching powder is steady. Prices are unchanged for the week. Bleaching powder is quoted at from $2 to $2.25 per 100 pounds, in drums, at works.

CASEIN—The casein market reports demand as fair. Prices are lower for the current week. Domestic standard ground casein is quoted at 13 cents per pound; domestic finely ground casein at 14 cents per pound, all in bags, car lot quantities.

CAUSTIC SODA—The demand for caustic soda continues good. Prices are firm. Solid caustic soda is offered at from $2.10 to $2.30 per 100 pounds; flake and ground at from $2.50 to $2.70 per 100 pounds, in drums, at works.

CHINA CLAY—The china clay market continues about on the level of the previous week. Quotations of imported clay range at from $14.50 to $25 per ton, ship side. Domestic filler clay is offered at from $6.50 to $12 per ton; coating clay at from $11 to $22 per ton, at mines.

CHLORINE—The demand for chlorine is reported as steady. Prices are firm and unchanged. Chlorine is quoted at $2.15 per 100 pounds, in single-unit tank cars, f.o.b., works.

ROSIN—The rosin market reports demand as fair. Prices are lower for the week. Paper making rosin is offered at $6.50; wood rosin at $7.00 per 280 pounds, gross weight, in barrels at Savannah. Seventy per cent rosin size is quoted at $3.20 per 100 pounds, in tank cars, f.o.b., shipping point.

SODA ASH—The soda ash market continues steady. Quotations on soda ash in car lots, at works, per 100 pounds, are as follows: in bulk, $.90; in bags, $1.05; and in barrels, $1.35.

SALT CAKE—The demand for salt cake continues on the level of the preceding week. Prices range at from $12 to $13.50 per ton; chrome salt cake at from $11 to $12, f.o.b., shipping point. Imported salt cake is quoted at from $14.50 to $15 per ton, Gulf or Atlantic Seaboard, on dock.

STARCH—The demand for starch continues about on the level of the preceding week. Prices are lower for the current week. Globe pearl starch is quoted at $3.15 per 100 pounds, in bags, and at $3.40 in barrels. Special paper starch is offered at $3.25 per 100 pounds in bags, and at $3.50 in barrels. All prices in car lots, f.o.b., Chicago.

SULPHATE OF ALUMINA—The sulphate of alumina market is steady. Prices are unchanged. The commercial grades are quoted at from $1.25 to $1.60; iron free at from $2 to $2.25 per 100 pounds, in barrels, at works.

SULPHUR—The demand for sulphur is about on the level of the preceding week. Annual contracts are quoted at $18 per long ton, f.o.b., cars at mines. Spot and nearby car lots are quoted at $21 per ton; all prices in car lots.

TALC—The talc market reports no change in demand or prices for the week. Domestic talc is quoted at from $15 to $18 per ton, Eastern mines. Imported talc is offered at from $25 to $40 per ton, on dock.

Market Quotations

Paper

Tissues—Per Ream—

White No. 1	1.10	@	—
White No. 1 M. G.	1.07½	@	—
White No. 1½	.77½	@	—
White No. 2	.75	@	—
Anti-Tarnish M. G.	.77½	@	—
Colored	.90	@	—
Kraft	.77½	@	—
Manila	.75	@	—
Unbleached Toilet	2.90	@	3.30
Bleached Toilet	3.94	@	5.26

Paper Towels—

Unbleached	2.10	@	3.35
Bleached	3.30	@	3.70

Manila—

No. 1 Jute	9.00	@	9.25
No. 2 Jute	7.75	@	8.50
No. 1 Wood	4.00	@	5.25
No. 2 Wood	3.50	@	4.00

Fibre Papers—

No. 1 Fibre	4.25	@	5.50
No. 2 Fibre	4.00	@	4.75

(Delivered New York)

News, per ton—

Roll, contract	42.50	@	—
Sheets	47.50	@	—

Kraft—

No. 1 Northern	5.25	@	5.75
Standard	5.00	@	—
Southern	4.50	@	—
Machine glazed, plain, striped	5.00	@	—

Boards, per ton—

News	37.50	@40.00
Chip	35.00	@37.50
Sgl. Mla. Ll. Chip	52.50	@ —
Jute Lined Chip	52.50	@ —
White Pat. Coated	65.00	@67.50
Kraft Liners	55.00	@ —
Binders Boards	75.00	@80.00

The following are representative of distributors' resale prices:—

Rag Content Bonds and Ledgers—
White, Assorted Items,
Delivered in Zone 1:

	Bonds	Ledgers
100% Rag Ext.		
No. 1	$41.40@$48.50	$42.55@$50.00
100% Rag	32.80@ 38.50	33.95@ 39.75
85% Rag		32.20@ 37.75
75% Rag	24.75@ 29.00	25.90@ 30.50
65% Rag	21.65@ 26.25	22.80@ 27.75
50% Rag	18.70@ 22.75	19.90@ 24.25
25% Rag	15.80@ 19.25	16.95@ 20.75

Regular Colors @ $1.50 cwt. extra.
Heavy Colors @ $3.00 cwt. extra

Sulphite Bonds and Ledgers—
White, Assorted Items,
Delivered in Zone 1:

	Bonds	Ledgers
No. 1	$9.35@$11.50	$10.55@$12.75
No. 2	8.50@ 10.25	9.65@ 11.75
No. 4	7.60@ 9.25	8.80@ 10.75

Regular Colors @ $1.50 cwt. extra.
Heavy Colors @ $3.00 cwt. extra.

Free Sheet Book Papers—
White, Cased Paper,
Delivered in Zone 1:

No. 1 Glossy Coated	$12.15@$14.25
No. 2 Glossy Coated	10.55@ 12.25
No. 3 Glossy Coated	9.35@ 11.00
No. 4 Glossy Coated	8.80@ 10.50
No. 1 Antique (watermarked)	8.80@ 10.50
No. 2 Offset	8.05@ 9.50
A Grade E. F.	7.90@ 9.50
A Grade S. & S. C.	8.15@ 9.75
B Grade E. F.	7.30@ 8.75
B Grade S. & S. C.	7.55@ 9.00
C Grade E. F.	7.00@ 8.50
C Grade S. & S. C.	7.25@ 8.75
D Grade E. F.	6.75@ 8.25
D Grade S. & S. C.	7.00@ 8.50

Ivory & India at $.50 cwt. extra.

Mechanical Pulp

(On Dock, Atlantic Ports)

No. 1 Imported—

Moist	35.00	@	36.00
Dry	40.00	@	42.00

(Delivered)

No. 1 Domestic and Canadian	36.00	@	37.50

Chemical Pulp

(On Dock, Atlantic, Gulf and West Coast Ports)

Bleached Sulphite (Domestic and Foreign)—

Prime Bleached Sulphite	3.50	@	4.65
Prime Qualities—Easy-Bleaching Sulphite	3.25	@	3.75
Strong Unbleached Sulphite	2.75	@	3.65

(On Dock, Atlantic Ports)

Kraft Bleached	4.00	@	4.75
Kraft Light & Strong	3.00	@	3.75
Kraft No. 1	2.75	@	3.65
Kraft No. 2	2.50	@	2.75

(F.o.b. Pulp Mill)

Kraft Domestic	2.00	@	3.00

(Delivered)

Soda Bleached	3.25	@	—

Add 60 cents per short ton, dock charges for Albany; $2.50 for Lake Ports East and $3.50 for Lake Ports West of Mackinac Straits.

Domestic Rags

New Rags

(Prices to Mill f. o. b. N. Y.)

Shirt Cuttings—			
New White, No. 1	8.25	@	8.75
Silesias, No. 1	6.63	@	6.88
New Unbleached	8.75	@	9.00
Blue Overall	6.75	@	7.00
Fancy	3.50	@	3.75
Washables	2.50	@	2.75
Mixed Khaki Cuttings	4.25	@	4.50
O. D. Khaki Cuttings	4.75	@	5.00

Old Rags

White, No. 1—			
Repacked	3.75	@	4.25
Miscellaneous	3.00	@	3.25
White, No. 2—			
Repacked	2.60	@	2.85
Miscellaneous	2.00	@	2.25
Thirds and Blues—			
Repacked	2.00	@	2.25
Miscellaneous	1.75	@	2.00
Roofing Rags—			
No. 1	1.45	@	1.50
No. 2	1.15	@	1.25
No. 3 (bagging)	.80	@	.90
No. 4	.80	@	.90
No. 5A	.65	@	.75

Foreign Rags

New Rags

New Dark Cuttings	2.25	@	2.40
New Mixed Cuttings	2.00	@	2.20
New Light Silesias	5.50	@	5.75
Light Flannelettes	5.50	@	5.75
New White Cuttings	7.00	@	7.50
New Light Oxford	4.00	@	4.50
New Light Prints	3.00	@	3.25

Old Rags

No. 1 White Linens	7.50	@	8.50
No. 2 White Linens	6.50	@	7.50
No. 3 White Linens	4.50	@	5.50

Let us take care of your REJECTIONS, over-runs or seconds.

We have branches in fourteen different cities and can sell your rejections for you at a minimum expense to you; wherever they occur.

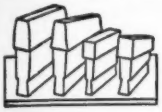
THE SABIN ROBBINS PAPER COMPANY

STATION A CINCINNATI, OHIO

WOOD COGS

OF ALL DESCRIPTIONS, BLANK OR FINISHED

From Thoroughly Seasoned New Hampshire Rock Maple



The Best Cog Stock in the World

THOMPSON MANUFACTURING CO.

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CLINTON STARCHES

Special Grades for Beater and Top Sizing

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CLINTON, IOWA

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The Original Chrome Nickel Alloy for the Paper Mill

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Special Castings, Fittings, Valves, Pipe, etc.

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Builder of High Speed Bag Machines

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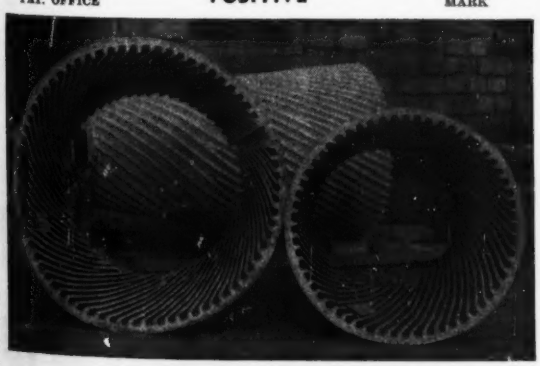

Spiral Type Jordan Fillings

THE BAHR BROS. MFG. CO.

OUR SPECIALTY IS JORDAN FILLINGS

SPIRAL TYPE JORDAN FILLINGS
TWIN SPIRAL BAR JORDAN FILLINGS
THE OLD TYPE BAR JORDAN FILLINGS

Jordan fillings for every kind of stock, and for every known trade name and size Jordan. The bars, made of our stainless metal, resist the action of chemicals; also plain to meet the requirement in rough stock mills.

Place your refining problem up to us. Our high speed refiners are built for belt or V-belt drive; also for direct connected.

Your inquiries will have our prompt attention.

MARION, INDIANA, U. S. A.

No. 4 White Linens	2.25	@	3.25
No. 1 White Cotton	4.25	@	4.75
No. 2 White Cotton	3.25	@	3.75
No. 3 White Cotton	2.50	@	3.00
No. 4 White Cotton	1.90	@	2.20
Extra Light Prints	2.00	@	2.40
Ord. Light Prints	1.75	@	2.15
Med. Light Prints	1.55	@	1.95
Dutch Blue Cottons	2.25	@	2.50
French Blue Linens	3.00	@	—
Checks and Blues	2.00	@	—
Linsey Garments	2.10	@	2.20
Dark Cottons	1.75	@	1.85
Old Shopperies	1.60	@	—
New Shopperies	1.60	@	—
French Blues	2.25	@	2.50

Old Rope and Bagging

(Prices to Mill f. o. b. N. Y.)

Gunny No. 1—			
Foreign	2.40	@	2.60
Domestic	2.25	@	2.35
Wool Tares, light	1.75	@	1.85
Wool Tares, heavy	2.10	@	2.15
Bright Bagging	1.60	@	1.70
Manila Rope—			
Foreign	3.50	@	3.75
Domestic	3.75	@	4.00
Jute Threads	2.75	@	3.00
Sisal Strings	2.35	@	2.45
Mixed Strings	Nominal		

Old Waste Papers

(F. o. b. New York)

Shavings—			
White Envelope Cuttings	3.10	@	3.25
Ordinary Hard White No. 1	2.60	@	2.70
Hard White No. 2	2.40	@	2.50
Soft White No. 1	2.30	@	2.40
Flat Stock—			
Stitchless	1.10	@	1.15
Overissue Mag	1.10		1.15
Solid Flat Book	.80	@	.90
Crumbled No. 1	.60	@	.70
Ledger Stock	1.55	@	1.60
New B. B. Chips	.35	@	.40
Manila—			
New Env. Cut	2.15	@	2.25
New Cuttings	1.65	@	1.75
Old Kraft Machine—			
Compressed bales	1.15	@	1.25
News—			
No. 1 White News	1.40	@	1.50
Strictly Overissue	.60	@	.70
Strictly Folded	.35	@	.37½
No. 1 Mixed Paper	.27½	@	.30

Twines

(F. o. b. Mill)

(Soft Fibre)			
Coarse Polished—			
India	.15	@	.16
White Hemp	.16	@	.17
India Compress	.16½	@	.17
Fine Polished—			
Fine India	.20	@	.20
Unpolished—			
Box	.11	@	.13
Paper Makers	.09½	@	.11
Tube Rope	.11½	@	.14¼
Wall Paper	.13½	@	.14¼
Wrapping	.14	@	.17
Soft Fiber Rope	.14¾	@	.15¾
(Hard Fibre)			
Medium Java	.12	@	.13
Mex. Sisal	.12	@	.12½
Manila	.22	@	.29½
Domestic	—	@	3.75
Transmission Rope	2.10	@	2.40
Soft Jute Ropes	2.25	@	2.35
Jute Carpet Threads	1.75	@	2.00
Gunny No. 1—			
Foreign	2.35	@	2.40
Domestic	2.00	@	2.10
Bleachery Burlap	4.00	@	4.10
Scrap Burlap—			
Foreign	2.15	@	2.35
Domestic	1.75	@	1.90
Scrap Sisal	1.90	@	2.10
Scrap Sisal for Shredding	2.40	@	2.60
Wool Tares, heavy	—	@	2.15
New Burlap Cuttings	2.45	@	3.00
Aust. Wool Pouches	3.50	@	3.65
Heavy baling bagging	2.25	@	2.35
Paper Mill Bagging	1.50	@	1.60
Bagging No. 2	.85	@	1.00

Domestic Rags (New)

(F. o. b. Boston)

Shirt Cuttings—			
New Light Prints	.03	@	.03¼
New White No. 1	.07½	@	.07¾
New White No. 2	.05½	@	.05¾
New Light Flannelettes	—	@	.06
Silesias No. 1	.03¾	@	.04
New Black Silesias	.03¾	@	.04
Silesias No. 1			
Soft Unbleached	.08	@	.08¼
Blue Cheviot	.06¼	@	.07
Fancy	.03¼	@	.03½
Washable	.03	@	.03¼
Cottons—According to grades—			
Blue Overalls	.06½	@	.06¾
New Black, soft	.03¾	@	.04
Khaki Cuttings	.04	@	.04½
O. D. Khaki	.04¼	@	.04½
Corduroy	.02¾	@	.03
New Canvas	.07¼	@	.07¾
B. V. D. Cuttings	.08¼	@	.08½

Domestic Rags (Old)

(F. o. b. Boston)

Canvas	.04½	@	—
White No. 1—			
Repacked	—	@	2.75
Miscellaneous	2.50	@	2.75
White No. 2—			
Repacked	1.90	@	2.00
Miscellaneous	2.00	@	2.25
Twos and Blues	1.75	@	2.00
Third and Blues—			
Repacked	1.37½	@	1.75
Miscellaneous	1.25	@	1.62½
Black Stockings	3.90	@	4.00
Roofing Stock—			
No. 1	—	@	1.40
No. 2	—	@	1.15
No. 3	—	@	1.05

Foreign Rags

(F. o. b. Boston)

Dark Cottons	1.40	@	1.50
Dutch Blues	2.85	@	3.00
New Checks and Blues	2.85	@	3.00
Old Fustians	2.50	@	2.60
Old Linsey Garments	1.90	@	2.00
New Silesias	6.00	@	6.50

PHILADELPHIA

Domestic Rags (New)

(Price to Mill, f. o. b. Phila.)

Shirt Cuttings—			
New White, No. 1	.07½	@	.08
New White, No. 2	.04½	@	.05
Light Silesias	.05½	@	—
Silesias, No. 1	—	@	.05½
Black Silesias, soft	.03	@	.03½
New Unbleached	.07½	@	.08
Washable, No. 1	.02	@	.02¼
Blue Overall	.04½	@	.05
Cottons According to grades—			
Washable, No. 2	—	@	.01¾
New Blue	.01½	@	.01¾
Fancy Percales	—	@	.03½
New Black Soft	.03	@	.03½
New Light Seconds	—	@	.05½
New Dark Seconds	1.25	@	1.50
Khaki Cuttings—			
No. 1 O. D.	.03½	@	.04
No. 2 Mixed	—	@	.02¾
Corduroy	.02¼	@	.03
New Canvas	.06	@	.06½
New Black Mixed	.02	@	.02¾

Domestic Rags (Old)

White No. 1—			
Repacked	3.00	@	3.25
Miscellaneous	2.50	@	2.75
Thirds and Blues—			
Miscellaneous	2.00	@	2.25
Repacked	2.25	@	2.50
Black Stockings (Export)	4.00	@	4.50
Roofing Stock—			
Foreign No. 1	1.50	@	1.75
Domestic No. 1	1.50	@	1.70
Domestic No. 2	1.30	@	1.40
Roofing Bagging	—	@	1.25

Bagging

(F. o. b. Phila.)

Gunny, No. 1—			
Foreign	1.80	@	2.00
Domestic	2.00	@	2.25
Manila Rope	3.75	@	4.00
Sisal Rope	2.00	@	2.25
Mixed Rope	1.00	@	1.10
Scrap—			
No. 1	1.50	@	1.75
No. 2	1.00	@	1.25
Wool Tares, heavy	3.25	@	3.50
Mixed Strings	1.00	@	1.10
No. 1 New Light Burlap	3.00	@	3.50
New Burlap Cuttings	2.00	@	2.25

Old Papers

(F. o. b. Phila.)

Shavings—			
No. 1 Hard White	2.55	@	2.75
No. 2 Hard White	2.40	@	2.55
No. 1 Soft White	2.25	@	2.30
No. 2 Soft White	1.50	@	1.75
No. 1 Mixed	.80	@	.90
Solid Ledger Stock	1.75	@	1.85
Ledger Stock, white	1.50	@	1.60
Ledger Stock, colored	1.35	@	1.45
No. 1 Books, heavy	1.05	@	1.10
Manila Cuttings	1.75	@	1.85
Print Manila	.50	@	.55
Container Manila	.45	@	.50
Kraft Paper	1.15	@	1.20
No. 1 Mixed Paper	.35	@	.45
Straw Board Chip	.40	@	.45
Binders Board Chip	.40	@	.45
Corrugated Board	.50	@	.55
Overissue News	.60	@	.65
Old Newspapers	.40	@	.45

BOSTON

Old Papers

(F. o. b. Boston)

Shavings—			
No. 1 Hard White	2.25	@	2.40
No. 1 Soft White	1.85	@	2.15
No. 2 Mixed	.75	@	.80
Solid Ledger Books	1.50	@	1.75
Overissue Ledger Stock	1.30	@	1.50
Mixed Ledgers	.85	@	.90
No. 1 Books, heavy	.90	@	1.00
No. 1 Books, light	.65	@	.75
Crumpled Stitchless Book Stock	.50	@	.60
Manila Env. Cuttings	1.60	@	1.70
Manila Env. Cuttings, extra quality	2.20	@	2.30
No. 1 Old Manila	.95	@	1.00
White Blank News	1.30	@	1.40
No. 1 Kraft	1.35	@	1.45
Mixed Papers	.25	@	.30
Print Manila	.55	@	.60
Container Manilas	.27½	@	—
Old Newspapers	.30	@	.35
Paper Wool Strings	—	@	.60
Overissue News	.45	@	.50
Box Board Chips	.35	@	.40
Corrugated Boxes	.30	@	.40
Kraft corrugated boxes	—	@	1.00
Screening Wrappers	.55	@	.60

Bagging

(F. o. b. Boston)

Manila Rope—			
Foreign	—	@	3.50

CHICAGO

Old Papers

(F. o. b. Chicago)

Shavings—			
No. 1 White Envelope Cuttings	3.15	@	3.25
No. 1 Hard White	2.50	@	2.60
No. 1 Soft White	2.05	@	2.10
Ledger & Writings	1.30	@	1.40
Solid Books	1.20	@	1.25
Blanks	1.40	@	1.50
Krafts	.90	@	1.00
New Kraft Cuts	1.70	@	1.80
Manila Env. Cuts	2.15	@	2.25
Ex. No. 1 Manila	2.15	@	2.25
Print Manila	1.70	@	1.8
Overissue News	.60	@	.70
Old Newspapers—			
No. 1 Folded News	.45	@	.50
No. 1 Mixed Paper	.35	@	.40
Roofing Stocks—			
No. 1	2.00	@	2.1
No. 2	1.85	@	2.0

TORONTO

Paper

Bonds and Ledgers

Delivered

No. 1 White	.35½	@	.36½
No. 1 Tints	.36½	@	.37½
No. 2 White	.26½	@	—
No. 2 Tints	.27½	@	—
No. 4 White	—	@	.1550
No. 4 Tints	.16	@	.1650
No. 5 Bond—White	11.35	@	—
No. 5 Bond—Tints	12.35	@	—
No. 5 Bond—Golden Rod	13.35	@	—
No. 5 Ledger—White	.1185	@	—
No. 5 Ledger—Tints	.1285	@	—
No. 6 Bond—White	10.75	@	—
No. 6 Bond—Tints	11.25	@	—
No. 6 Bond—Golden Rod	12.75	@	—
No. 7 Bond—White	9.10	@	—
No. 7 Bond—Tints	9.60	@	—
No. 7 Bond—Golden Rod	11.10	@	—
Book—			
No. 1 M. F.	7.10	@	7.35
No. 2 M. F.	6.85	@	7.20
No. 3 M. F.	5.60	@	6.20
No. 1 S. C.	7.60	@	7.85
No. 2 S. C.	7.10	@	7.35
No. 3 S. C.	6.10	@	6.35
No. 1 Coated and Litho	12.50	@	—
No. 2 Coated and Litho	11.00	@	—
No. 3 Coated and Litho	9.50	@	10.00
Coated tinted	13.00	@	13.50
Wrapping—delivered—			
Rag Brown	4.85	@	5.55
White Wrap	4.00	@	—
"B" Manila	4.90	@	6.25
No. 1 Manila	5.50	@	7.00
Fiber	5.50	@	—
Kraft, No. 2	5.50	@	—

(F. o. b. Cars, Toronto)

News, per ton—			
Rolls (contract)	38.50	@	—
Sheets	45.50	@	—

Pulp

Ground wood	32.00	@	—
Unbleached Sulphite	59.00	@	—
Book (Class 1)	71.00	@	—
Writing (Class 2)	72.00	@	—
Select (Class 3)	73.00	@	—

Old Waste Paper

(In carload lots, f. o. b. Toronto)

Shavings—			
White Env. Cut	2.50	@	—
Soft White	2.15	@	—
White Blk. News	1.25	@	1.40
Book and Ledger—			
Flat Magazine and Book Stock (old)	1.00	@	—
Light and Crumpled Book Stock	.85	@	—
Ledgers and Writings	1.20	@	—
Manilas—			
New Manila Cut	1.50	@	—
Printed Manilas	.65	@	—
Kraft	1.00	@	1.10
News and Scrap—			
Strictly Overissue	.65	@	—
Strictly Folded	.60	@	—
No. 1 Mixed Paper	.50	@	—

Domestic Rags

(Price to mills, f. o. b. Toronto)

No. 1 White Shirt Cuttings	.09	@	.09
Fancy Shirt Cuttings	.03½	@	.03